Vol. 21 October, 1927 No. 2

QUARTERLY

OF THE

National Fire Protection Association

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40 CENTRAL STREET, BOSTON, MASS.

National Fire Protection Association

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Western Factory Insurance Association.
Western Insurance Bureau.
Western Sprinkled Risk Association.
West Virginia Fire Underwriters' Association.
West Virginia Inspection Bureau.
Wisconsin Inspection Bureau.

Over 4,300 Associate Members

Table of Contents.

WOODEN SHINGLE ROOFS IN BUFFALO ..... FRONTISPIECE

EDITORIALS 109

PICTORIAL COMMENT. *Cartoons* 113

CAPE COD FOREST FIRE PREVENTION TEST. *Harris A. Reynolds* 115

HOME DRY CLEANING TRAGEDY, TORONTO 119

ELEPHANTS PUT OUT FIRE 124

THE FOURTH OF JULY TOLL 124

CROSS CONNECTIONS AND FIRE-SERVICE CHECK VALVES 126

BERLIN FIRE BRIGADE IN FIRE PREVENTION. *H. Henne* 130

BOSTON'S "PUP" FIREBOAT. *Photographs by Harry Belknap* 132

STUDYING PLANT PROCESSES TO PREVENT FIRES. *Benjamin Richards* 133

CHICAGO'S RUBBISH FIRE PATROL 142

HOW FIRES ARE PUT OUT IN PITTSBURGH 143

SCHOOL FIRES 144

- FAMOUS SCHOOL DISASTERS 145
- LOSS OF LIFE IN SCHOOL FIRES 163
- OTHER LOSS OF LIFE SCHOOL FIRES 167
- FIRE RECORD OF SCHOOLS 173

ST. CROIX PAPER COMPANY FIRE 193

GASOLINE TRUCK AND TRAIN COLLISION AND FIRE 195

FIRES IN WHICH THERE WAS LOSS OF LIFE 197

Reports of fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

Wooden shingle roofs as far as the eye can reach, ready to receive any chance spark and cause a conflagration destroying a large portion of Buffalo. This picture was taken by Field Engineer Bugbee and E. L. Ballard (Member N.F.P.A.), during Mr. Bugbee's recent visit to Buffalo in the interest of legislation to stop the further extension of this hazard.

The Quarterly

Vol. 21 October, 1927 No. 2

Fire Protection Nostrums. As the advertising man might say, the public is becoming "fire-conscious." The average individual has become educated to the point where fire hazard or fire protection is a useful sales argument to the promoters of devices or materials that have to do with fire safety. The cumulative effect of years of effort in public education in fire prevention, and the advertising of fire-resistive materials, fire protection equipment, etc., promotes the sale of all devices and products in this field. But it likewise offers a golden opportunity to sell fire protection nostrums of all kinds, parasites on the business of the legitimate manufacturer. The man on the street now appreciates the need for fire protection, and is often willing to pay for it, but he does not yet know enough about the subject to discriminate between standard devices and the grossest of frauds.

There has in the past year or so been an alarming increase in these nostrums, the fake fire extinguisher being now particularly in evidence. Dry powder tubes and hand grenade extinguishers, discredited by fire protection authorities twenty-five or thirty years ago, are being sold to the gullible public, which is glad to salve its conscience by buying the cheapest device offered. "Fire-proof" paints, no more effective or permanent than ordinary whitewash, are marketed to take advantage of the fire prevention publicity attendant upon the adoption of ordinances requiring fire retardant roofing or extending fire limits.

The N.F.P.A. as an organization can do much to restrict the promotion of fire protection frauds; in many cases the Association seems to be the only disinterested body which is free to act in exposing such frauds. But as in all the activities of the Association the effectiveness of our work must rest upon the efforts of the individual members who, each in his own community or group, must be depended upon to keep the fake fire extinguishers and the like in check until the public can distinguish between a dry powder tube and a standard extinguisher and no longer fondly believes that a coat of "fireproof" paint will make a four-story wooden schoolhouse fire-safe.

Fire Prevention Week, 1927. Fire Prevention Week 1927 again eclipses all previous records, according to reports from Mr. T. Alfred Fleming, Chairman of the N.F.P.A. Committee on Fire Prevention and Clean-Up Campaign which are confirmed by the volume of Fire Prevention Week correspondence handled by the Executive Office. For several years the pessimists have been predicting that our annual Fire Prevention Week observance would peter out, that the day of such campaigns is passing, that competition of Eat-More-Prunes Week and similar commercial campaigns would divert public interest from projects such as ours. But experience has completely refuted such gloomy predictions, as anyone would believe who could see the N.F.P.A. Executive Office as it works overtime during the period before Fire Prevention Week, hard pressed to fill the orders for posters and other Fire Prevention Week literature, handling an annually increasing volume of correspondence about the week from Chambers of Commerce, business men, fire departments, public officials, schools and others having a purely public spirited and distinterested concern in the subject.

Fire Prevention Week has been established as a permanent annual institution. It is of course only one of the fifty-two weeks in the year during all of which the prevention of fire is of equal importance. But until we reach the point where all will practice fire prevention the year round without the need for any special stimulus, Fire Prevention Week must continue as a very necessary and valuable part of the activities of the Association.

* * * * *

A New Fire-Maker. "When Spraying Ends, Fire Making Begins" is the amazing advertising slogan of the G-V Sprayer, manufactured by the G V Sprayer Company of Wichita, Kansas, and sold at a moderate price in paint, hardware and department stores throughout the country. The spray process of applying paints and lacquers in industrial plants under sub-standard conditions has been responsible for much loss of life and property by fire. The same process, extended to the home, gives considerable ground for concern. The spraying of finishes having highly flammable solvents, by householders unfamiliar with the properties of these materials and who may use them in small kitchens without ventilation and with gas flames burning, seems to invite small scale repetitions of the fires and explosions that have occurred in industrial plants. But the hazard of spraying paint or lacquer with this device is dwarfed into insignificance by its advertised success as a "fire-maker." Quoting from the advertising circular:

"A fire in half a minute, with a thimble full of kerosene and two or three gallons of air"

"A wonderful pipe thawer"

"A perfect sterilizer for metal and other non-combustible material"

"When you make a general clean-up of the poultry house by removing nests, etc., if you keep the flame moving there is no injury to the woodwork but the mites will give up the ghost as they not only get intense heat, but also a deposit of boiling kerosene"

"A fine paint remover...."

"For cleaning your motor, spray motor with kerosene and let stand over night, then spray with gasoline"

"Heats manifold and starts Ford in ten seconds"

"Use your G-V Continuous Variable Sprayer to thaw frozen pipes; to burn the soot out of chimneys; to burn brush and the 'suckers' off growing trees"

No possible comment on these astounding quotations seems adequate—except perhaps the following further quotations, in which may be seen a meaning probably not contemplated by the writer: "The sprayer is perfectly adapted to the use of the housewife or amateur in the brightening up and renewing of the interior equipment of the home".... "Once tried, you will never make a fire in any other way."

* * * * *

"Your Money's Worth."

"Your Money's Worth," by Stuart Chase and F. J. Schlink, recently distributed to the "Book of the Month Club," paints an amazing picture of the waste and the buncombe attendant on present day advertising and distribution of the necessities and luxuries of living. The helpless consumer is pictured as Alice in Wonderland, for example paying for a widely advertised antiseptic solution at the rate of $495.00 for antiseptic effect that could be obtained with one cent's worth of a certain common chemical. The authors show how the individual purchaser of clothing, foodstuffs, automobiles and a thousand and one articles of everyday need has no criterion of quality, no way of knowing what is best for his purposes, and is perforce led by national advertising and high pressure selling methods which add enormously to the retail cost and furnish no reliable aid in the selection of products.

Some of the reviewers have taken decided exception to the conclusions of this book, but none can question the authors when they say: "We note here and there a public release of helpful facts. The National Fire Protection Association can tell you a good deal about the fire hazards of specific building materials. It publishes a pamphlet, for instance, on the 'Menace of the Wooden Shingle'—and we have traced no subsidy from the copper and zinc associations! Impartial, honest, competent advice it is."

The Metal Kite Hazard. The increasing substitution of steel for wood as a material of construction generally operates to reduce the fire hazard, but not always so. An interesting exception is reported by Member Herbert H. Sutton of Dallas, Texas.

Kites with metal frames instead of wood have been sold in Dallas during the past year. The small boy's kite all too frequently finds its final resting place in overhead wires. An ordinary kite with a wooden frame entangled in electric light and telephone wires is innocuous, but a kite 15 x 21 in. with a frame of No. 10 wire soldered together may result in short circuiting high and low tension wires and carrying high voltage currents to telephone wires, with the likelihood of fires, accidents, and interruptions to the service of the electric light and telephone companies.

In Dallas this hazard has been controlled by an ordinance prohibiting, under penalty of a $200 fine, the sale or the flying of kites with metal frames. If this hazard becomes general the authorities in other cities must consider the adoption of similar measures.

A $500,000,000 BONFIRE

Winsor McKay in the *New York American.*
(Copyright 1927, New York American, Inc.)

WE NEED A POLITICS PREVENTION WEEK

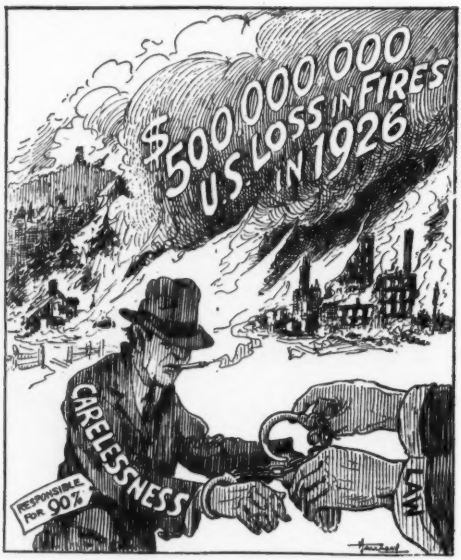
Halladay in the Providence *Journal*

Closing the Door on These Gangs

Illustrating Article by E. W. West in the *Federation News*

DURN'D IF I CAN LIGHT IT. DO IT AGAIN. LET'S SEE YOU DO IT AGAIN. DO IT SLOW.
WATCH, NOW. JUST AS EASY. YOU SORT O FLIP THE HEAD QUICK, WITH YOUR THUMBNAIL. THAT'S ALL— JUST PRACTICE.
THE GUARDIAN ANGELS WERE, LIKELY, JUST AS BUSY DURING THE FLINT & STEEL AGE
9 17 27

Dwig in the Boston *Traveller (McClure Syndicate)*



Halladay in the Providence *Journal*

Cape Cod Forest Fire Prevention Test.

By Harris A. Reynolds,
Secretary, Massachusetts Forestry Association.

Much emphasis has recently been laid upon the importance of public education as a factor in forest fire prevention, but in the main we have had no method of measuring the value of such educational campaigns. An experiment is now under way in Massachusetts which is designed to show in dollars and cents the actual results of public education and patrol in forest fire prevention.

The Massachusetts Forestry Association, the United States Forest Service, the Massachusetts Conservation Department, the Boards of Selectmen, the local Forest Wardens, and the people of the towns concerned, each have a part in this experiment. The area selected for this experiment comprises the towns of Barnstable, Bourne, Falmouth, Mashpee, Sandwich and Yarmouth on Cape Cod because this district is practically surrounded by water, and at the same time it constitutes one of the highest forest fire hazards in the Eastern States. The pitch pine and the scrub oak in mixture are the predominant species and both are highly flammable. Nearly 20 per cent of the forest area has been burned over in one year.

The Association is charged with the educational work, the Federal and State Forest Services with the patrol, the local wardens with suppression of fires and the public with special care in the use of fire. The cost of the educational work, of patrol and suppression, will be carefully kept for a period of three years, also the number of acres burned over, and these figures will be compared with the cost of suppression and the area burned over for the three years prior to the experiment. It is really a national experiment to prove that the use of preventive measures is more effective than suppression alone. In other words, we aim to determine whether it is more efficient to spend money in advance for the *prevention* of forest fires or for the *suppression* of fires after they are started.

Results of the First Two Years.

Since nearly all of the large forest fires occur in this district during the spring months, this report practically covers the first two years of this three-year experiment. During the three years prior to the beginning of this experiment on January 1, 1926, there was an average of 9,363 acres burned over annually in these six towns, and the average annual cost of suppression alone was $9,829.

Last year under the methods used in the experiment the total cost for *education, patrol* and *suppression* was $12,452, and the acreage burned over

Harvard Forest.

Typical scene of desolation in burnt over forest area on Cape Cod.

was 3,771. Compared with the average of the previous three years the cost last year was 26.7 per cent greater, but the loss in acres burned was reduced by 59.7 per cent. The cost of two automobiles, fire fighting equipment for the patrolmen, large warning signs, and special work in education, each of which will serve its purpose for the three years, was charged against the first year. When these expenditures are prorated over the three-year period the actual cost for the first year was about the same as the average annual cost for the suppression alone, and the loss was reduced by about 60 per cent.

This year to June 1, which practically ends the fire season for the year, the total cost for education, patrol and suppression was $3,283, and the total area burned over was 1,025 acres. Based on the costs of the ordinary year, only 42 per cent has been spent this year and the losses have been reduced by 89 per cent.

When we take the experiment as a whole to date, the expenditures have been 11 per cent less than under the old system, and the losses in acreage burned over have been reduced by 72 per cent. These results have been obtained during two exceptionally bad fire years. In fact this past season has been the worst since 1911.

Fire Prevention Methods Employed.

The educational work was begun by the Massachusetts Forestry Association January 1, 1926. Our forester, equipped with motion picture films, bulletins describing the experiment and setting forth methods of fire prevention, posters and other educational material, spent three months in the district giving talks to all the schools, boards of trade, women's clubs, fraternal

Massachusetts Dept. of Conservation.

Forest plantation, East Sandwich, Mass. Red pine planted twelve years ago. Old road harrowed to serve as fire line.

organizations, civic associations, church clubs, and similar groups—in fact, to every kind of gathering where the showing of the pictures was possible. Conferences with individuals and small groups were held in every community. The lecturer of the United States Forest Service also spent a week in the district giving special talks to selected groups. By the end of the three months practically every man, woman and child in the district knew about the experiment, and what each could do to help. The press devoted much space to the experiment, and the railroads, electric power companies and manufacturers pledged their hearty co-operation.

Immediately following the educational campaign, the State Forester appointed two men who were familiar with the district to act as forest rangers. These men patrolled all the roads, visited camp and picnic grounds, distributed fire prevention literature, interviewed the occupants of all automobiles found parked in the woodland or along the roadside, saw that no brush or rubbish burning was done except under permit, reported all fires and the cause of the same, suppressed small fires discovered, disposed of fire hazards, so far as possible, such as paper and rubbish left on picnic grounds, inspected town dumps frequently, and kept the subject constantly before the public. These rangers were provided with Ford cars equipped with small truck bodies in which they carried a number of water cans with hand pumps, shovels and other tools for fire suppression. They wore distinctive uniforms and police badges. During the year 1926 they per-

sonally attended 117 fires, traveled 28,000 miles, and interviewed over 8,000 persons.

Clearing Roads.

As a phase of the educational work the Massachusetts Forestry Association offered to meet half the cost of clearing the brush from abandoned public and old logging roads, in order to enable the fire fighters to reach fires in the incipient stage. There were areas ranging from 1,000 acres to 4,000 acres without a road passable for motor equipment and a fire starting in one of those large areas could not be reached until it had burned almost to a road. Each town in the area met the other half of the cost of this work within the town. A total of $3,980 was spent last year and 125 miles of these roads were opened to travel with fire trucks. It is estimated that 50 miles more must be brushed out in order to complete the job and reduce the large tracts of forest lands to areas averaging about 160 acres. The town meetings have appropriated $1,200 for this purpose this year and the Association has agreed to pay a like sum, which is to be raised by private subscription.

The most encouraging feature of the whole experiment thus far is the change that is noted in public sentiment toward the fire problem. The people now have renewed hope that productive forests can again be established on Cape Cod. Greater interest in reforestation has been shown because of this determined effort to solve the fire problem. The towns have continued their appropriations for planting on town forests, the state is establishing a new nursery on the state forest and individuals have begun to reforest their idle lands.

Idea Spreading.

The idea embodied in this experiment has already begun to spread, and the town of Plymouth, which adjoins the experimental area, this year employed six forest fire patrolmen on Saturdays, Sundays and holidays. During other bad fire years the acreage burned over in that town ranged from 4,000 to 6,000 acres, and special appropriations had to be made for fire fighting. Although this was the worst forest fire year in Massachusetts since 1911, only about half of the regular appropriation for this work was spent and the losses in acres burned were less than 300.

Home Dry Cleaning Tragedy, Toronto.

Three people were killed and four injured in an explosion and fire in Rosedale, Toronto, on Saturday afternoon, October 1. The explosion was due to the use of gasoline in a washing machine to clean curtains. The following account from the *Toronto Evening Telegram* of Monday, October 3, gives the main features of the disaster:

Three persons are dead, four others lie on beds of pain, crushed and burned, while two escaped unscathed when an explosion in the cellar smashed to atoms the home of Charles R. House, 179 Douglas Drive at 3.12 Saturday afternoon.

A great gaping hole in the ground, surrounded by a blackened, wet mass of ruins of brick, mortar and charred timber, with hundreds of sightseers, curious and eager, walking and stumbling over the débris, marks the spot today of that tragedy, one of the worst in Toronto history.

A child of three years lay dead in that mass of ruins for five and a half hours, while firemen vainly battled the flames and fought their way to her side. When they uncovered the little body it was found that the left leg had been burned off at the hip and the right leg was off to the knee, but the face was not burned. Death was probably due to suffocation.

Meanwhile the parents of the little one lay dying in the General Hospital, terribly crushed and burned by the explosion.

Mrs. House died at 4.55 a.m. Sunday and her husband at 8.25. Both had been taken from the wrecked house by rescuers, and, despite their own burns, had begun a frantic hunt for their children until persuaded to go to near-by houses to receive medical attention.

The Dead.

Charles Roy House, aged 40, father, who died of first and second degree burns in Toronto General Hospital, at 8.25 Sunday morning Oct. 2.

Mrs. Jean House, aged 36, mother, who died of first and second degree burns in the General Hospital at 4.55 Sunday morning.

Baby Jean House, aged two and half, who perished in the ruins and whose body was recovered some five hours later by firmen.

In Hospital.

Jackie House, aged four, burned about the arms, face and legs. In Wellesley Hospital, recovery expected.

Miss Hesther Goldie, Finnish cookmaid, cut about the arms and legs and suffering from shock and slight burns. In Toronto General Hospital.

Miss Lulu Histikka, aged 23, Finnish nursemaid, fractured pelvis feared, hands and legs burned. In Toronto General Hospital.

Slightly Injured.

Joan House, aged 8, hands and legs slightly burned.

Escaped Injury.

Victor House, aged 12, eldest child, who escaped uninjured by jumping through rear window to safety.

Adrienne House, aged 10, who jumped into arms of man when stairway was blown away.

No official report has been received on this disaster as this QUARTERLY goes to press; the data for this article are taken from the *Toronto Daily Star* and the *Toronto Evening Telegram*, whose reporters made circumstantial investigation of the explosion and fire. While there is question as to the accuracy of some of the minor details of this report, it is believed substantially correct in all essential features.—Ed.

Toronto Evening Telegram.

Ruins of the home of Mr. and Mrs. House, Toronto, after the explosion which took three lives on Saturday, October 1, 1927. This explosion was due to the use of gasoline for home dry cleaning.

Two other children and a maid were blown out of the house, burned and injured, while a boy and another servant jumped or were hurled to safety.

Gasoline being used, with an electric washing machine, to clean some curtains, and ignited by an electric spark evidently caused the explosion, which wrecked the 3-story 12-room house. A kitchen clock sets the time at 3.12 P.M. The hands of the clock stopped at this time. Two minutes after this what had once been the home of a family of seven and two maids was a mass of débris.

Three in Cellar.

As far as could be learned, Mr. House and his wife were in one of the compartments in the cellar, cleaning some curtains with gasoline. Victor, 12, eldest of the five children, was lying on the bed in his own room reading. Adrienne, aged 10 years, was preparing to take a walk with Baby Jean, aged three, and at three o'clock made her intentions known to the maid who looks after Jean. Before going, Adrienne wanted a book to read and went to the cupboard in her room to search for it. The maid and Baby Jean were in an attic room.

Jackie, aged four, and Joan, aged eight, were in rooms downstairs. The family were thus spread over the house, when a terrible explosion rent the air, followed by a rumble like thunder. Victor was thrown out of bed and the cupboard caved in on Adrienne. The maid upstairs with Baby Jean can remember nothing until she awoke in a neighboring house and does not know what happened to the baby.

Jumped to Safety.

Victor, choking from the smoke and débris fumes, groped his way blindly to his bedroom window. "I have been used to jumping quite frequently from this window," Victor

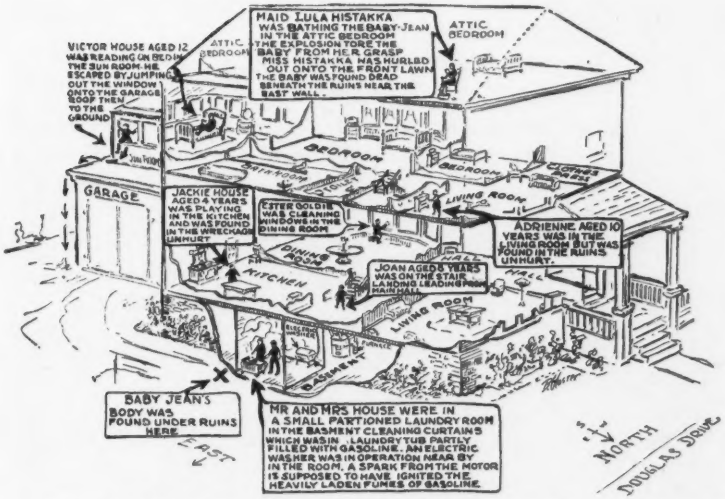

MAID LULA HISTAKKA WAS BATHING THE BABY-JEAN IN THE ATTIC BEDROOM THE EXPLOSION TORE THE BABY FROM HER GRASP MISS HISTAKKA WAS HURLED OUT ONTO THE FRONT LAWN THE BABY WAS FOUND DEAD BENEATH THE RUINS NEAR THE EAST WALL.
ATTIC BEDROOM
VICTOR HOUSE AGED 12 WAS READING IN BED IN THE SUN ROOM HE ESCAPED BY JUMPING OUT THE WINDOW ONTO THE GARAGE ROOF THEN TO THE GROUND
ATTIC BEDROOM
BEDROOM
BEDROOM
GARAGE
JACKIE HOUSE AGED 4 YEARS WAS PLAYING IN THE KITCHEN AND WAS FOUND IN THE WRECKAGE UNHURT
ESTER GOLDIE WAS CLEANING WINDOWS IN THE DINING ROOM
LIVING ROOM
ADRIENNE AGED 10 YEARS WAS IN THE LIVING ROOM BUT WAS FOUND IN THE RUINS UNHURT.
DINING ROOM
HALL
JOAN AGED 8 YEARS WAS ON THE STAIR LANDING LEADING FROM HALL
KITCHEN
LIVING ROOM
BASEMENT
BABY JEAN'S BODY WAS FOUND UNDER RUINS HERE
MR AND MRS HOUSE WERE IN A SMALL PARTITIONED LAUNDRY ROOM IN THE BASEMENT CLEANING CURTAINS WHICH WAS IN LAUNDRY TUB PARTLY FILLED WITH GASOLINE. AN ELECTRIC WASHER WAS IN OPERATION NEAR BY IN THE ROOM. A SPARK FROM THE MOTOR IS SUPPOSED TO HAVE IGNITED THE HEAVILY LADEN FUMES OF GASOLINE
EAST
NORTH
DOUGLAS DRIVE

Diagram of the House residence printed by the "Toronto Evening Telegram," showing where the several people were at the time of the explosion and the manner of escape of those on the upper floors.

told *The Telegram,* "so I knew where to land. I didn't wait to get my clothes. I just groped to the window, leaped out and landed on the ground unhurt. I don't know what happened after that, it all came so sudden."

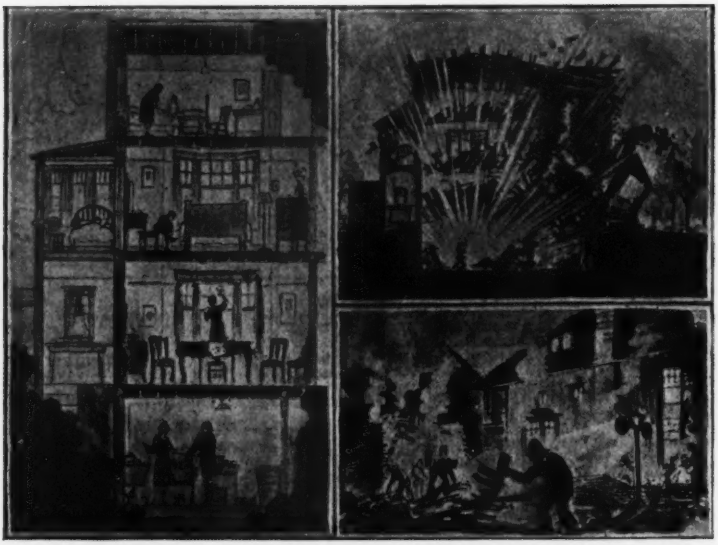
"And I was in the cupboard when there came a bang and it fell in on me," Adrienne took up the story. "I got out somehow. I ran to the stairway and was going to start down when I found there was no stairs. They had been blown away. Just then I saw a man there and he told me to jump. I jumped into his arms."

For some moments a state of chaos reigned. Father and mother ran hither and thither, disregarding their own terrible hurts, searching and calling their children. Meanwhile someone had picked up Jackie, aged four.

Others picked up Joan, who was burned about the hands and legs, and carried her to the home of a neighbor, where medical help was called. Victor and Adrienne were taken to another neighboring house. Miss Hiltikka, the cook-maid, was not hurt, but shaken up and frightened, and she went with the two last-named children. The other maid was picked up and taken away to a doctor's home, where she was attended to and sent to a hospital.

During all this time neither father nor mother would listen to the pleas of the rescuing neighbors to look after themselves. Mr. House finally persuaded his wife that she needed some help and she was immediately put under medical care. The father himself, his clothing smouldering, his body terribly burned, refused aid, threw off any blankets that were thrown on him and attempted to rush into the burning ruins in search of his baby. He missed the baby, having accounted for all the other children.

Dashing here and there, forced to retreat by the terrible volume of smoke that poured from the débris, the heat and flames, the father became frantic. Finally he was persuaded that all would be done that was possible and he was made to take care of himself.



The Toronto home dry cleaning tragedy as portrayed by Galbraith O'Leary, artist of the "Toronto Daily Star." The drawing at the left shows the interior of the house a moment before the blast. The drawing at the upper right shows the explosion and the lower right the firemen searching the ruins for the body of the baby.

Cause of the Explosion.

The available evidence indicates that early Saturday afternoon Mr. House brought home three five-gallon cans of gasoline to use in a washing machine for cleaning curtains. Whether all or only part of this gasoline was used in the washing machine located in the basement is not clear, but even a fraction of this amount of gasoline would be sufficient to cause a violent explosion. There was no fire or gas flame in the basement or anywhere near the small laundry where the washing was done. The supposed cause of ignition is an electric spark from the washing machine motor, although a spark of static electricity created by the friction of the curtains in the machine may have been responsible.

The explosion was obviously more violent as it occurred in a tightly enclosed basement room. According to the statements of people in near-by houses there was no violent detonation. The explosion was sufficiently violent, however, so that extensive structural damage was done by the initial concussion, evidence indicating that the front part of the house was blown towards the street and that the building was practically demolished by the explosion before the ensuing fire had gained any great headway.

The escape of several people from the house seems little short of miraculous. A maid who was either working in the cellar with Mr. and Mrs. House or cleaning on the first floor (as shown in diagrams) was blown out on to the lawn by the force of the explosion, according to the reports of interviews printed in the newspapers. The reports vary as to how Mr. and Mrs. House escaped from the cellar, but they were outside of the building immediately following the explosion. Neither succumbed to the effects of their burns until some hours afterwards. The explosion was sufficiently violent so that material damage was done to the adjoining dwellings on both sides of the House residence, although it is probable that most of the damage to adjoining property was due to fire.

It was apparently some ten minutes after the explosion before the fire alarm was sounded, the fire department arriving very promptly after the alarm was given. Their efforts were directed to extinguishing the fire and cooling the ruins so as to permit reaching the body of the child who was killed. Although the explosion occurred at 3:12 P. M. the body of the child was not found until 9 P. M. after a long search of the ruins.

—Whittlings

Elephants Put Out Fire.

A story is printed in the Bangkok papers of how a herd of wild elephants in Travancore, southwest coast of India, organized themselves into a fire brigade and put out a blaze which was threatening to become a big forest fire.

During a gale a large tree was uprooted and fell across the main trunk road in Travancore State, near Theorm Custom House. Some laborers who had been sent to clear away the débris set the tree on fire so as to lessen their work. When night came they returned to the Custom House, leaving the tree still burning, with its sparks constantly being blown into the dry forest. The fire was gaining headway there when the leader of a herd of wild elephants smelled the fire and came to the road in order to satisfy his curiosity. The rest of the story as told in Bangkok is:

> The moment he saw the fire spreading to the forest he called his followers by loud trumpeting and within a few moments a well-disciplined band of dusky four-footed firemen were busily employed with their trunks as hose turning forty streams of water on the blazing tree and burning woods.
>
> A running stream near by was a sufficient reservoir for them to draw their supply of water, and very soon, to the amazement of the wonder-struck laborers, who had been attracted by the trumpeting to the place where they should have been working, the fire was put out and, perhaps as a matter of revenge, the elephants dragged the fallen tree into the middle of the road and left it there.
>
> —*New York Times.*

The Fourth of July Toll.

One hundred and ninety-five deaths and 3,179 injuries resulted from the celebration of the Fourth of July this year, according to the American Museum of Safety, which conducted a survey of Independence Day casualties in more than 600 cities in 43 states.

Of the 195 killed, 31 were children under six years of age, and 122 were between the ages of six and twenty. Firecrackers, toy pistols, small cannons, Roman candles—even dynamite, added to the grim toll. Forty-eight of the victims were burned to death, their clothing becoming ignited by the so-called "harmless" sparklers and other fireworks. Blank cartridges were almost as fatal as burns, causing 46 deaths. Firecrackers took the life of 22. The eating of fireworks caused the death of 16 very small children, through phosphorus poisoning.

Twenty-seven of the deaths resulting from the celebration occurred before or after the Fourth, with 168 deaths on Independence Day itself. Of the

injuries, there were 2,774 on Independence Day, with 405 occurring before or after that date.

The State of New York led in the number of deaths, with 36. Other states reported as follows: Pennsylvania, 34; Illinois, 20; New Jersey, 15; Indiana, 11; Massachusetts, 10; California, 9; and Missouri, 8. Texas, with its large population, reported only 2 deaths.

The list of the injured shows that St. Louis again leads the big cities with 228, though this large number is believed to be in part due to the careful system of reporting all injuries in that city. The number of injuries in other large cities was: New York, 58; Chicago, 51; Brooklyn, 40; Philadelphia, 30; Detroit, 17; Cincinnati, 11; Boston, 3, San Francisco, 3. Only 39 of the more than 3,000 injuries were received as a result of public celebrations.

—N. Y. Daily News

Cross Connections and Fire-Service Check Valves.

By C. W. Mowry (Member N.F.P.A.)
Associated Factory Mutual Fire Insurance Companies.

The automatic sprinkler has made it possible to concentrate tremendous values with safety in industrial plants, mercantile buildings, and warehouses. The manufacturers of the country have taken advantage of this possibility to such an extent that adequate fire protection is now necessary for the profitable continuance of their business. A good public water system is the very best primary supply for automatic sprinklers, but municipal water supplies also cannot be depended upon in all cases for two reasons:

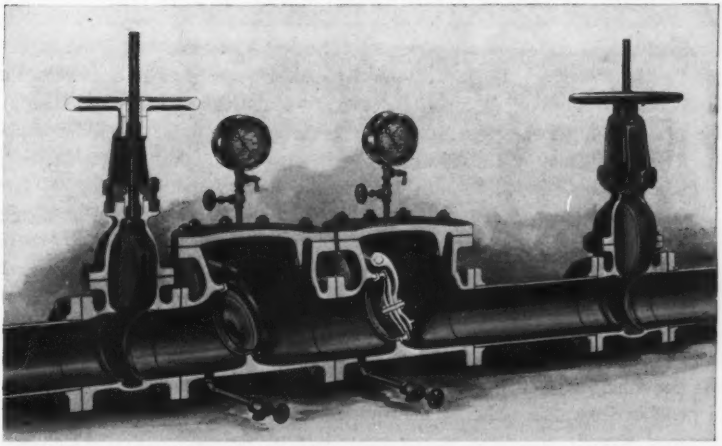
1. Fire will not wait in case the public water supply should happen to be out of service, and consequently if the tremendous advantages of automatic sprinklers in extinguishing fires at the start are to be realized, there must be pressure *always* on the sprinklers.
2. Public water supplies are frequently inadequate in volume and pressure for a large number of automatic sprinklers and hose streams which might be needed to cope with a serious fire.

Therefore, whenever the value protected or the fire or life hazard involved is sufficiently great, a secondary supply is needed in order that automatic sprinklers will control a fire at the start. The Labor Laws of some States permit double the number of employees in a building equipped with a sprinkler system supplied from two independent sources.

There is no practicable way of providing an alternative primary water supply which is the equivalent of a good public water system. Even large elevated tanks erected at great expense are necessarily of limited pressure and capacity.

It is even more difficult to provide a secondary supply of potable water of sufficient capacity to assure an adequate volume of water for an emergency, such as an unusually severe fire or a conflagration. Such secondary supplies, however, can be obtained by utilizing open bodies of water, as ponds and rivers. A cross connection is the only practicable method at present available of combining the reliability and big capacity of public water systems with that of available non-potable secondary supplies both automatically feeding into a common fire protection system capable of meeting the demands of sprinklers and hydrants during the progress of a fire. Such a cross connection in order to function instantly when fire occurs, must not depend upon manual operation, but must be automatic.

This is not an isolated problem, but a part of the larger one of utilizing the public water most efficiently for its three purposes,—domestic use, industrial use, and fire protection. To safeguard the public water against



Cross section of a set of double check valves, showing relation of gauges to clappers and to drains used for testing.

pollution, double check valves of proper design and regularly inspected, tested, and cleaned, are the best known means of utilizing public water to the fullest extent for fire protection.

Improved Fire-Service Check Valves.

The old-fashioned single check valve used on fire-service connections consisted simply of a swinging iron clapper hung within a valve body. The workmanship was not precise, and no special care was taken to have the metal-to-metal seats absolutely tight.

Nothing more was considered necessary in those early days. Public water supplies were often taken without filtration from rivers, lakes, and other natural bodies, and factory fire pumps drew water from these same sources to supplement the public water supply in case of fire. The check valve was merely a convenient means for confining the pump pressure whenever it should be maintained higher than the city pressure, and yet enabling either or both sources of water supply to be utilized automatically for fire purposes. In some instances, a by-pass was provided around the check valve, so that the factory fire pump could supply the community with water in case of emergency. Hence, in such cases it mattered little whether the check valve was perfectly tight or not.

These old-style check valves on fire-service connections were usually buried in the ground and, not being readily accessible, were not given periodic care. Rust gradually formed inside the valve bodies and hindered the free movement of the clappers. It is no wonder, therefore, that some of these

old valves were found leaking. But in those early years of fire protection, absolutely tight check valves were not considered necessary or important.

As time went on, rivers and ponds used as sources of public water supplies became polluted, making it necessary to safeguard the watersheds or else filter or otherwise treat the water before using it as a public supply. Then, the old-fashioned single check valves were no longer suitable. Something better was needed to safeguard public water supplies.

Nearly twenty years ago, the Factory Mutual Companies recognized this condition and felt a responsibility for public health along with the prevention of loss by fire. Therefore in 1908 the Factory Mutual engineers designed a special check-valve equipment for this important service. First of all, the valves themselves were greatly improved in design. All moving parts were made entirely of bronze. A clearance of three-quarters of an inch was provided between the body and the clapper at all positions of its travel, to provide free movement. The clapper was faced with rubber and was so mounted that it could be swung clear out of the valve body to facilitate cleaning when the cover is removed. The bolt holes in the cover flanges were slotted to afford quick and easy access to the interior for inspection and cleaning.

Then for each equipment, two of these improved valves were put in tandem, thus tremendously increasing the efficiency of the equipment, because with frequent tests for tightness and with regular cleaning of the interiors as planned, the probability of both valves leaking at the same time is made extremely remote. The two check valves in series were installed between two gate valves in a concrete pit, where they would be accessible at all times for inspection and maintenance. In addition, the check valves were provided with pressure gauges and test cocks, so arranged that the tightness of each check valve could be verified in a few moments.

More than one thousand sets of these double check valves have replaced single check valves on fire-service connections in the United States and Canada. We know of no case where public water supplies have become contaminated due to failure of any of these equipments. In fact, except in a few cases, it is only occasionally—and then for a short time—that the pressure against these fire-service check valves is higher than the city pressure, because the fire pump is not operated except for test or in time of fire.

A few years ago, Mr. C. D. Rice, Manager of the Underwood Typewriter Company, Hartford, Conn., became interested in the double check valves at his own factory. He took another step forward in improving the design by making the valve bodies and covers of bronze, so that with the interior parts already of bronze, all iron would be eliminated and the accumulation of rust would be avoided. Mr. Rice also improved the facing

on the clapper by making it in the form of a rounded rubber ring, which rests on the flat seat of the valve like an automobile tire lying on its side on a smooth floor. As the pressure increases on the back of the clapper, more and more of the rubber comes in contact with the seat, and this compression of the rubber widens and tightens the seal between the two water supplies.

With double check valves of suitable design installed on fire-service connections wherever the fire pump or other secondary supply utilizes non-potable water, and with a definite system of inspection which will insure that the valves are tested regularly and carefully for tightness and are cleaned thoroughly inside annually, under the supervision of the proper authorities, the danger that water from a fire-protective system will find its way into the public mains can be reduced to the vanishing point.

FIREMAN—*F'r heaven's sake, Lady, don't let go or I'll snap back and hit me poor buddies in the face.*

—*Judge*

Berlin Fire Brigade in Fire Prevention.

By Professor H. Henne (Member N.F.P.A.)
Direktor der Deutschen Feuerversicherungs-Vereinigung.

Fire prevention has for many years been considered an important function of the state and municipal governments in Germany, as well as of the insurance interests. Life safety from fire is the primary interest of the public authorities, but likewise from the economic aspect, fire prevention is considered a public responsibility.

The enforcement of fire prevention measures is delegated by law partly to the so-called "building police," the department of the government which fulfills the same function as the building inspector in most American cities, and partly to the "industrial police," whose function is roughly parallel to that of state labor departments and industrial commissions in the United States. With both building police and industrial police the fire department co-operates. This applies particularly to the larger cities and especially to the situation in Berlin to which the following observations refer.

The building police have control over the construction of buildings, making inspections to insure compliance with the law in new construction or alterations. In this connection fire exits receive especial attention. In respect to fire exits and other features of building construction having bearing on the fire hazard, the building police work closely with the fire department, the fire department passing on all projects for new construction or remodeling of department stores, office buildings, multi-story buildings, sheds, hotels "wine and beer palaces," public garages and buildings housing hazardous industrial processes. The building police also delegate to the fire department the determination of the adequacy of private fire extinguishing installations and general orders on fire prevention.

The industrial police, under state rather than municipal control, have a wide jurisdiction over all matters affecting the health and safety of employees in industrial plants. The so-called "fire police" are organized as a division of the industrial police, the industrial police having jurisdiction over all manufacturing industries and controlling not only new installations, but existing plants which may involve fire or accident hazard. For the enforcement of these regulations a technical staff is employed for the industrial inspections, made up of engineers, chemists and other technicians especially trained in analyzing the problems of the industries which they inspect.

As in the case of the building police, the industrial police co-operate with the fire department and work closely with the fire department in the following matters:

1. General fire prevention, building materials and construction, heating and lighting installations, fire exits.

2. Fire safety equipment and inspection of large department stores and office buildings, manufacturing plants and warehouses of hazardous occupancy, hotels and "beer palaces," motion picture film exchanges, gasoline and oil storage, the handling of hazardous chemicals, etc.

3. Permits for acetylene plants and for the manufacture of compressed flammable gases, as well as the preparation of installation and operation rules for all plants where flammable or explosive materials are handled or where there is particular danger of spontaneous ignition or other special fire hazard.

4. Transportation and storage of explosives.

5. The fire safety of exhibition buildings, bazars, Christmas fairs, etc.

6. Location of storage of lumber.

7. The prevention of fires in store windows owing to hazardous decorations or exhibits.

8. Pyrotechnic displays.

9. Amusement resorts.

The fire department co-operates with the so-called "street police" in respect to teaming of loads of hay and straw through the streets and the transportation of hazardous materials in general through the city.

The fire department works in close harmony with the other authorities concerned, and in fact has jurisdiction in such matters quite parallel to that of fire departments in American cities.

Fire prevention matters in the Berlin fire department are handled by a special division of fire prevention, which is managed by a director at the headquarters of the department. This special fire prevention division covers all matters of general policy and sees to it that in the various districts of the city the interpretations of the rules are uniform. All matters of primary importance are referred to the central fire prevention office before being passed upon.

Boston's "Pup" Fire Boat.

Photographs by Harry Belknap (Member N.F.P.A.)

This "pup" fire boat has been developed by the Boston Fire Department for use under piers and similar places where neither large fire boats nor land companies can reach. This boat has already demonstrated its value in several fires.

The "pup" alongside the large fire boat, ready to be hoisted on board on davits. The small boat is a rowboat equipped with a small gasoline engine driven pump, a length of small hose, and an outboard motor.

Studying Plant Processes To Prevent Fires.

By Benjamin Richards.
(Member N.F.P.A.)

Fires in manufacturing properties are usually divided into two classes, technically designated as those occurring under common hazards and those caused by special hazards. Common hazard fires are those which originate from rubbish and other uncleanliness, heating, lighting, power, including boilers, chimneys, and also fires from lightning are included in this class. Special hazard fires are those originating in or in connection with some special processes necessary to a particular industry. Common hazard fires run about the same for all classes while special hazard fires vary quite a little among the different classes of manufacture.

In a general way the cause of all fires is *improper maintenance,* and it is right here that a defect, so far as fire loss is concerned, in the modern industrial management may be discovered. In most industrial plants the general maintenance or upkeep department of the plant has in charge such matters as heating, lighting, arrangement of power drives and such other features as may include the causes of all, so-called, "common hazard" fires. A while ago when industrial plants were smaller and the management less involved, we could look to the maintenance department, or at least through that department to the general manager, to guard also the special hazards incident to the process work, and under such conditions the maintenance of proper safety against fire in the process as well as under the common hazards could be fairly well controlled.

Manufacturing Specialization.

Of late years manufacturing processes have become highly specialized, volume of production has been greatly increased and the values involved in any particular process have doubled and tripled over the former conditions. At the same time the general type of construction has materially changed toward a tendency to have many or all processes concentrated in one large room, the whole aim being to concentrate and to speed up work, especially the assembling and finishing processes. All this development is traceable to the employment of technical specialists whose efficiency and skill of production is one of the new wonders of the world.

Like all specialists, however, these well-meaning gentlemen have often failed to look beyond their specialty, and through their persistent effort toward efficiency and efficiency only, sometimes have neglected safety and

From address presented at the National Safety Congress, Chicago, September, 1927.

possibly other important factors which should enter into the manufacturing problem. These men differ very materially from the old style manufacturer, who under his daily task was compelled to consider many or all manufacturing problems, whether they related to finance, construction, purchases, sales, production, maintenance, employment or safety. Specialization has resulted in a divided authority in these matters with usually such a complicated organization that an appeal over the head of the management of one of these departments to a superior officer can be made with difficulty; and when such appeal is made, more often than not a fair, informed and unbiased judgment of the point in question is not obtained. The production man is usually a highly paid official, more or less dominating the whole organization, and as he is either indirectly or directly responsible for the profits of the whole, his words naturally go a long way when the question of overruling him, or compelling a change in his plans in the interest of fire safety or other desirable end, is under discussion.

Fortunately there are exceptions to the prevailing type. Indeed, these production men would be the last to acknowledge that they are sacrificing safety to accomplish their ends, but to one who has for years studied their methods and talked with them it does appear that there is a marked tendency on the part of these specialists, who are so successful in their own lines, to ignore the ideas of other specialists equally familiar with their own particular lines, especially when such specialties lie outside the scope of the usual work. Some of us who have studied manufacturing processes in their relation to the tremendous fire losses of this country have been often told by these production experts that their process was entirely safe, or that the particular conditions under which they were operating were in some respects superior to those used by everybody else, so that they could not suffer losses to property and life as do their neighbors under some such similar conditions.

False Economy.

Very often the defect in management is higher up than the production man. This defect may be best expressed as a false idea of economy, due mainly to the ignoring of the experiences of others who have lost their properties through fire, and to what may be called lack of balance in management, whereby the management is too much interested in certain phases of manufacturing rather than showing a broad general interest in the entire manufacturing problem, as best exemplified by the old type manufacturer who bought his own stock, supervised its manufacture, employed his own labor and sold his own goods.

An attempt is made in the large industries to parallel the old conditions, so far as it is possible, by meetings, or so-called conferences, where sit the heads of all the different departments; but so far as fire protection and general safety is concerned it may be assumed that seldom more than half of those

sitting at the table know anything about the subject at all. I remember one such meeting of the department heads of a very large industry at which they decided that a fire pump (essential to the safety of the plant) involving an expenditure of two or three thousand dollars could not be afforded; after which they promptly recommended an appropriation of about twenty thousand dollars for a swimming pool for the employees. Again, the larger the concern the closer it usually is to high finance and the high finance is usually a long way from the plant, so that even when a recommendation for safety is locally approved it has a tendency to dwindle in importance as it goes up the line until, when carried up to those holding the pocketbook, it appears to have no importance to them at all. Somebody in every large plant should have a liberal appropriation to apply to fire protection and general safety without question, as his best judgment may dictate, assuming of course that such a person knows his business.

Misleading Accounting Practices.

Another discovery we commonly make covers a matter which might well be called a defect in accounting. Under the arrangement we have in mind the production man may be thoroughly cognizant of the need of safeguards surrounding his proposed high pressure production layout, but the cost of the protection, both fire protection and safety to life, is charged to the production of his particular department. He must under such conditions work against his own good judgment, as he cannot very well take the position of recommending protection expense for a process which he is selling to his superiors on the basis of the savings which it will produce. Very often when an appeal is made and the management insists on the protection, there is then conflict as to whether the cost of the protection shall be charged to the maintenance department or to the production department. I believe that this modern attitude toward protection has been an indirect cause of many a fire loss.

Very many of our large losses and most of the small ones can be charged to these general defects in management. Bear in mind that no process, however dangerous, can be worked out by production specialists which cannot be reasonably safeguarded, both from a fire and loss of life standpoint, by those who are expert in this particular and highly technical work. The fire protection engineers are not a step behind the process engineers, and indeed often plans of protection have preceded the general introduction of some hazardous process. The responsibility for losses therefore is entirely upon the industries themselves and they have in their hands, and always have had, means for making all these processes safe.

Of course occasionally there may be a concern whose financial standing will not enable it to build good buildings in which to house a hazardous process or to safeguard such processes after they are housed, but these cases

are exceptional and do not apply to the large modern industrial plant which we are here discussing. Unfortunately the larger plant often employs people who have been brought up in a plant of this inferior class, and they are quite likely to surround themselves with the former conditions, to the detriment of the modern plant, which again is a question in management.

Fire-Resistive Buildings Made Fire-Traps.

We have seen excellent fire-resistive buildings made veritable fire traps by production managers or maintenance men filling them with wooden partitions, platforms, hanging shelving and other products of the lumber industry, although for years there have been on the market many non-combustible materials from which partitions and enclosures may be built, even at less cost than if built of lumber. We see production managers store skillfully purchased stocks of goods and supplies in the same room with, and alongside, a very hazardous process, where all the profit of the low price obtained by the purchasing department could be destroyed in ten minutes by a fire in the process; yet the production man seriously tells you that he cannot produce economically unless this million or so dollars' worth of supplies is ten feet from his ten thousand gallon tank of naphtha paint: neither he nor the management could possibly convey these goods to the assembly chain through fire doors in a brick wall or by means of automatic conveyors through similarly protected openings! When the ridiculousness of this position is finally impressed upon those in charge, they are more likely than not to resort to the statement that the fire wall will interfere with light and air, although it is generally recognized that such a wall would make ventilation easier, and artificial light is burning in any case, or light for the process is being furnished from the roof.

I once observed a case where a rare raw stock necessary to the industry had been collected at a tremendous expense after two years' work, the stock coming from isolated places at the ends of the earth. The stock itself was worth over a million dollars and must have cost at least fifty thousand dollars to collect, yet, when it arrived at the plant, it was placed in a large wooden shed partly used for a garage, where it all could have been destroyed by fire in twenty minutes; and under the market conditions of raw stock at that time this could have shut up the plant indefinitely.

The essentials of safety in any industrial plant, so far as fire is concerned, are very simple. They are best expressed by the common expression, "Do not put your eggs all in one basket." Raw stocks and supplies should be separated from the process and production departments by good fire walls, or preferably be in a separate building. Goods just as soon as made should be immediately passed to another fire division for storage, packing and shipping. Various modifications of this principle, as may involve valuable patterns, dies, jigs, rare stocks, etc., should be further considered.

Importance of Subdivision.

Of late years the craze for housing under one roof without walls, all in one large area, all processes, stocks and finished goods of the industry has what some consider strong arguments in favor of such a plant arrangement. While undoubtedly there are some advantages for such a type of plant, it may be safely assumed that it is a very expensive type to operate, unless one assumes 100 per cent production for 300 days in the year perpetually. With such a plant many acres are unnecessarily heated and lighted and involve other heavy overhead expense in spaces which are used for storage only, a condition which would ruin some of the older industries working on close margins. Storage buildings can be moderately heated and lighted for about 10 per cent of the cost of heating and lighting an ordinary work room, and the cost of heating we have in mind will cover the expense of heating the rooms, to say 40 degrees, to prevent sprinklers from freezing and in order that the expense of a dry pipe sprinkler system may also be avoided. Modern conveyors and escalators to receive the goods from the siding and distribute them throughout the warehouse and to feed them by gravity to the processing and assembly rooms all tend to further economy and fire safety. Storing finished goods in a manufacturing room subject to the fire hazard when such goods represent the maximum of values in thought, labor and material expense can only be described as foolhardy. Finished goods should be stored in absolute safety in rooms of a warehouse involving no special fire hazard, that the goods may be shipped and trade maintained even though the manufacturing plant may be shut down temporarily from a process fire.

Segregation of Hazardous Processes.

The same principle of subdivision applies to the process work itself. As a rule, the average manufacturing plant has only one or two spots which are very dangerous from the fire standpoint. For instance, in a cotton mill this is the picker room, and about 75 years ago the industry learned to cut off this department so that it might enjoy as many fires as it pleased without interfering with the other processes or the business as a whole. The old agricultural implement factory usually consisted of many buildings located 30 or 40 feet apart, the idea being that not more than one of them would be lost at one time. The latter arrangement of course is impractical under modern economic conditions but the practice as represented by the cotton mill picker room is used today and is just as practical to meet the modern conditions as it was 75 years ago, yet this principle is notoriously ignored by plant designers, architects and production engineers.

Assuming that a slight saving might be made on production by having all the processes in one room, when figuring the matter on a production basis only, it may yet be easily seen that if all factors are figured into the problem,

such as the probable cost of interruption by fire, insurance costs and other matters relating to safety and isolation of the hazardous process, even at the expense of the pride of the production specialist, subdivision is essential. Why destroy acres of non-hazardous production machinery because of one necessarily hazardous spot in the whole assembly? However, as to the matter of expense it may be safely assumed that in 99 cases out of 100 there is no ultimate extra expense involved in providing safety.

Fire Safety and Low Production Costs.

Fortunately safety measures fit nicely into plans for low production costs. We have seldom, if ever, sold an industry any elaborate fire protection but that industry has later acknowledged the part which this protection plays in earning its share of the low production cost. Just as proper warehousing saves heat and light, general overhead for repairs and maintenance, so safeguarding a manufacturing process saves on production in many ways. Knowing of the safety, the help appears more efficient, a better class of help may be employed, the process may be speeded up without increasing the danger, and as fires in certain processes are absoultely unavoidable the losses from shut down become unimportant. For instance, the automatic foam protection which the fire protection engineer some years ago developed for the protection of the large automatic dipping processes in the automobile plants has reduced the time of shut down from these fires to (in one case) 20 minutes where formerly the same machine without the fire protection was shut down a week by a fire. Besides there was practically no loss in the one case as against many thousands of dollars loss in the other.

Any production manager is, or should be, familiar with the particular part of his production where fires may be expected. In a machine shop the heat treating department involving the use of fuel oil is the dangerous place. In other metal working and woodworking plants the finishing, such as the use of paints and lacquers, is the most hazardous process; in the textile mills the preparation of the stock; in paper mills the wood preparing or other stock preparing buildings. All these departments can be easily isolated, and with little more cost can be housed in fire-resistive buildings, so that the fires which occur in them cannot interfere seriously with the work. Formerly the heart of the industry, the power plant, was found defective, but the importance of building fire-resistive power plants has for some years been recognized and we have little, if any, trouble from this defect in the modern plant. The use of pulverized fuel and the burning of oil has resulted in some serious fires in these fire-resistive plants, but these are again matters which can easily be safeguarded by conforming to the standard regulations for the protection of these hazards. If this same principle, long recognized as necessary to power plants, can be recognized in building and arranging that portion of the plant housing hazardous processes, a very great gain in safety can be easily made.

Poor Location of Hazards Invites Loss.

This appeal for a sensible internal arrangement of stock processes and goods in the plant is one which we cannot over-emphasize. The problem is especially severe for the smaller plant, such as the woodworker, where, assuming a three or four story building, for light and air the painting process is placed in the upper story. The painting process causes most of the fires. When the fires occur they are of such a nature that a large amount of water is usually necessary for their extinguishment, either from sprinklers, hose streams or both. In such a plant the assembly or work room is just below this floor, and down on the lower floors and possibly in a basement finished goods and stocks are stored.

The ridiculousness of this arrangement, from a fire loss standpoint, can be easily recognized when we observe that every little fire in the paint department, and they are many, must necessarily cause a wetdown of all the processes and goods below. In other words, a three or four hundred dollar fire in the paint room is quite likely to run into hundreds of thousands of dollars on account of the defective arrangement of occupancy. We are trying to help the situation some by developing waterproof floors for such rooms in the hope that most of the water can be diverted to the outside of the building before it gets to the stories below, but this is a difficult and expensive cure for a fundamental defect. Obviously the only proper cure is to confine the finishing to one building or one fire section, and the process and finished goods to other sections. Such an arrangement can be worked out just as well for a small plant as for a large one.

Need for Special Protection.

So far as the protection of the more highly dangerous hazards is concerned there is more or less controversy. Quite a few people, mostly within the industries but unfortunately many connected with the insurance companies, are likely to assume that ordinary means of protection, such as the chemical extinguishers, hose, sprinklers, etc., will safeguard these hazards. In the general proposition this may be true, but even if such fires are controlled by these devices there is usually a needless loss involved in their extinguishment. It is essential therefore that special engineering service be obtained to outline the special protection needed for any particularly hazardous process, and assuming such advices come from a reliable source they should be promptly complied with, as all possible arguments favor such special protection.

The most recent and possibly the most hazardous process we have to consider today is the prevailing method of applying paint and especially pyroxylin lacquer by the process of spraying. This involves a serious consideration of arrangement and protection that these fires may not result in loss of life and in damage to other processes and goods. The serious losses in this process

have been due mostly to ignoring the danger on the part of certain of those interested in production and to improper fire protection. It is safe to say that all these fires may be easily controlled. It is only necessary to recognize that they are extremely quick fires, releasing a large amount of heat in a very few moments, so the ordinary fire protection cannot cope with the hazard. Much more water is needed than can be applied through an ordinary sprinkler system and much prompter action is necessary in applying this water than is obtained through the ordinary operation of the fusible link now used in sprinklers. I just heard the other day of the sixth fire in one of these rooms where the hazard is very great. The first two losses were serious, as proper protection had not been provided; but the last fires, and this last one in particular, although the fire was as great as ever before, involved practically no loss, the protection provided having taken care of the fires nicely. These hazards may be easily controlled by certain supersensitive devices arranged to turn on a large amount of water upon development of the first rise of heat, and arrangements are made whereby this large amount of water discharged for extinguishment may be disposed of without involving a loss on other property or goods. The National Fire Protection Association's rules for caring for this paint spraying hazard do not call for any sacrifice in modern production methods, and the records to date indicate that when such rules have been complied with there has been no material fire loss in such protected areas and no loss of life.

The preceding discussion has dealt with the need of studying fire hazards in a broad way as they relate to the general production and manufacturing management. The particular details for the protection of all these hazards are available to all interested, so our problem is not so much the discussion of these details as the discussion of their general neglect. The title of this paper is "Studying Plant Processes to Prevent Fires," and this is an appeal for the actual study of these processes to prevent fire and to avoid danger to life upon the part of the production experts and those having in charge the management of our industries.

Analysis of Ultimate Fire Protection Cost.

It is fair to assume that this fire-safety feature is just as important a factor as one of the items to be studied on introducing a new process as are the construction, occupancy, finance, labor and production problems which go with it. Possibly more progress could be made if the production man were relieved of the burden of expense for fire protection, as it is now charged to his process. It would seem that all costs of insurance, fire protection, safety to life and co-related matters should be grouped into one account, called a protection or safety account. Very often the cost of insurance is kept separate from these things and the management is much misled as to his cost of protection, of which total cost the actual money paid for insurance premiums

is but one item. Fire protection is an expense chargeable to all industries and if the cost of upkeep of fire apparatus and protection, with the cost of insurance, were charged to such an account the actual cost of the protection as a whole would be accurately determined. The cost of fire protection, regardless of conditions and the quality of insurance purchased, is always about the same, being the sum of insurance premiums plus the cost of fire protection and its maintenance. The higher the premiums paid the less the cost of fire protection, while a high cost of fire protection involves low premium payments. There is therefore no reason why any special fire protection cost should be applied to a particular process or be chargeable to that particular department, as it is a fundamental overhead charge for protection, perfectly legitimate, and represents a cost to which all departments of the industry should contribute and a saving in insurance cost reflected back on the overhead of all departments.

This point is respectfully submitted to those industrial managers who have not given this matter careful consideration, as the first principle to apply in studying methods to reduce fire losses from processes and other causes. With this principle established there will be little resistance to expenditures for fire protection throughout all the departments, and protection will be recognized in the daily planning and estimating of the work and so become one of the necessary and ordinary subjects for consideration in all plant layout work. Having proceeded thus far, the working out of the detail for protection is a simple matter, for where there is a will there is a way and, as has been stated, there are ample rules and regulations and advisers always ready to give freely all the time necessary to those interested; and they are making a sincere effort to prevent property and life losses and to secure the attendant benefits of continuity of production and ultimate saving in manufacturing costs which such efforts are bound to produce.

We also hope that the day is not far distant when we all may assume that a production engineer who prepares plans for a hazardous production layout without including therein adequate provision for its safety is incompetent and does not know his business.

Chicago's Rubbish Fire Patrol.

An inspection plan originated by Chief Jerry Falvey of the Fourth Battalion of the Chicago Fire Department promises to cut down the number of runs almost one-third, according to *Fire,* the Chicago Fire Department monthly publication.

The idea is merely a regular patrol to stop rubbish fires. A couple of men in an antiquated flivver brought about such remarkable results in Chief Falvey's battalion that orders have been issued to all companies in the Department to watch for rubbish fires, extinguish them and notify the persons responsible that they are liable to arrest. The co-operation of the Police Department has also been requested.

Glancing over his battalion report recently, Battalion Marshal Falvey noticed that 60 per cent of the alarms responded to in his territory had been started by bonfires. Acting on Section 1538 of the Municipal Code, which expressly prohibits the lighting of fires in alleys, streets, yards, or anywhere else, in fact, except in stoves and furnaces, the Chief determined to eliminate the practice in his own district.

The Fourth Battalion has a tremendously large population and is considered one of the hottest fire districts in the city. It is on the near northwest side, bounded by Augusta Street on the south, Diversey Parkway on the north, the river on the east, and Kedzie Avenue on the west. Battalion Marshal Falvey sent a squad to scour the district for bonfires and to notify the populace that he intended to enforce the law to the last letter. They traveled the streets and alleys for several days and reported 500 blazes, all of which were extinguished with warnings to those who had built them.

Results of the campaign against bonfires were shown in the daily reports of several engine companies, typical of which is that of Engine 57, at Western and Haddon avenues. Engine 57, manned by a group of veteran fire-eaters, averages fifteen alarms daily. On one day shortly following the inauguration of the campaign was a perfect blank so far as alarms were concerned. The company did not receive a call. And altogether the number of alarms in the Fourth Battalion has been cut two-thirds, it is estimated.

The annual report of the Committee on Fire Patrol of the Chicago Board of Underwriters for the year 1926 lists the number of alarms responded to as 26,636, of which 8,245, or nearly one-third, were rubbish and bonfires in streets and alleys. These were alarms; not necessarily fires which caused property damage. But every bonfire was a potential hazard, and every alarm sent from three to seven pieces of apparatus rushing through the streets.

How Fires Are Put Out in Pittsburgh.

Brooms, salt, and snow are included in the fire extinguishing methods employed by the Pittsburgh Fire Department, as shown in the table below, which has been prepared by combining the tables given in the reports of the Pittsburgh Fire Department for the years 1923-1926 inclusive, as published by the National Board of Fire Underwriters.

Automatic Sprinklers	12
Automatic Sprinklers, Extinguishers and Chemical Streams	1
Automatic Sprinklers and House Streams	11
Beating out with Brooms, etc.	375
Buckets of Water	1233
Buckets of Water and Brooms	71
Buckets of Water and Salt	22
Chemicals and Automatic Sprinklers	7
Chemicals and Brooms	11
Chemicals, Brooms and Buckets of Water	10
Chemicals and Buckets of Water	70
Chemicals and Engine Streams	68
Chemicals, Extinguishers, etc.	4067
Chemicals and Garden Hose	10
Chemicals, Garden Hose and Private Hose Lines	6
Chemicals, House, Mill or Factory Stream	8
Chemicals, Hydrant and Engine or Pumper Streams	79
Chemicals and Plug Streams	835
Chemicals, Plug and Extinguisher Streams	5
Chemicals, Plug Stream and Sand	1
Chemicals and Salt	6
Chemicals and Sand	2
Engine or Pumper Streams	179
Extinguishers and Brooms	33
Extinguishers and Buckets of Water	20
Extinguishers and Garden Hose	4
Extinguishers and Plug Streams	21
Garden Hose	40
Garden Hose and Brooms	5
Garden Hose and Buckets of Water	1
Garden Hose, Private House Lines and Mill or Factory Lines	75
Plug Streams and Automatic Sprinklers	3
Plug Streams and Brooms	7
Plug and Engine Streams	271
Plug or Hydrant Streams	1420
Private, Mill or House Streams	22
Pumper Streams and Brooms	1
Removing Aerial Wire	1
Salt	55
Salt and Water	13
Salt, Sand and Water	92
Sand	4
Sand and Water	9
Shutting off Ammonia Line	2
Shutting off Electric Current	6
Shutting off Gas	13
Shutting off Gas and Electric Current	44
Shutting off Gasoline Line	1
Shutting off Oil Line	1
Shutting off Steam Line	1
Snow	2
Steam	7
Steam Line, Plug and Engine Streams	1
Streams from Locomotive	1
Services of Fire Department not required	3560
Total	12825

School Fires.

The public responsibility for the safety from fire of school children is generally recognized; the fire record shows to what limited extent this responsibility has been met. The National Fire Protection Association has constantly emphasized the importance of school fire safety and has consistently advocated fire-resistive school buildings with proper exits, special fire protection for existing buildings, particular care in fire prevention and the various other measures applying. A code for the proper construction and exit arrangement of school buildings has been developed by the Association through its Committee on Safety to Life, numerous educational pamphlets on this subject have been published, and the Quarterly has regularly printed reports on important school fires.

The modern trend in school building construction represents a distinct improvement in construction and exit arrangements over that prevailing a decade or more ago. Many of the more recently built school buildings are of first-class fire-resistive construction with ample exits. But there are still a large number of schools being built in which fire safety has not received sufficient consideration; where the exterior walls are of substantial construction, giving the semblance of fire safety, but where the interior is "built to burn." Likewise in some cities much has been done to improve the safety of the older buildings. Some of the more dangerous structures have been abandoned altogether for school purposes, others have been provided with automatic sprinklers and additional exits, and other fire safety measures have been taken. But schools continue to burn at the rate of five a day, according to the statistics of the National Board of Fire Underwriters.

Ample information is available in the publications of the National Fire Protection Association as to the proper construction and protection of school buildings. Anyone who wishes to construct a fire-safe school or to remodel an existing school building in the interest of fire safety can readily obtain information as to the best methods to follow. Unfortunately there still are many who have no conception of the seriousness of the fire problem and who must be shown detailed evidence before they can be persuaded to act to safeguard the children of their communities. This detailed evidence, the fire record, is familiar to all those who have made a particular study of this problem. The records of school fires assembled on the following pages are not intended as the presentation of new data, but as a compilation of the fire experience in form available for convenient reference.

The material on the general subject of fires in schools has been subdivided into a number of separate articles: famous school fire disasters where

major losses of life have occurred; a tabulation and statistical analysis of loss of life in school fires; detailed records of other typical fires where loss of life has occurred; a comprehensive analysis of school fires, including tables of causes, classes of buildings, places of origin of fire and the like, and selected reports of typical fires illustrating points of special interest, such as the hazard of nitrocellulose motion picture film, the effectiveness of sprinklers and the value of fire drills.

Famous School Disasters.

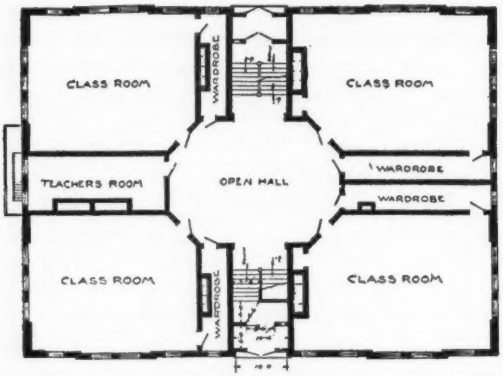
Six school fires in which three hundred and fifty-three deaths occurred are described in detail in this article. There are included here the four major school fire disasters of the past five years and the two previous school holocausts to which reference is most frequently made. These fires have been selected for more complete treatment than can be given the other loss of life fires recorded in the following pages.

Lakeview School, Collinwood, Ohio, March 4, 1908.

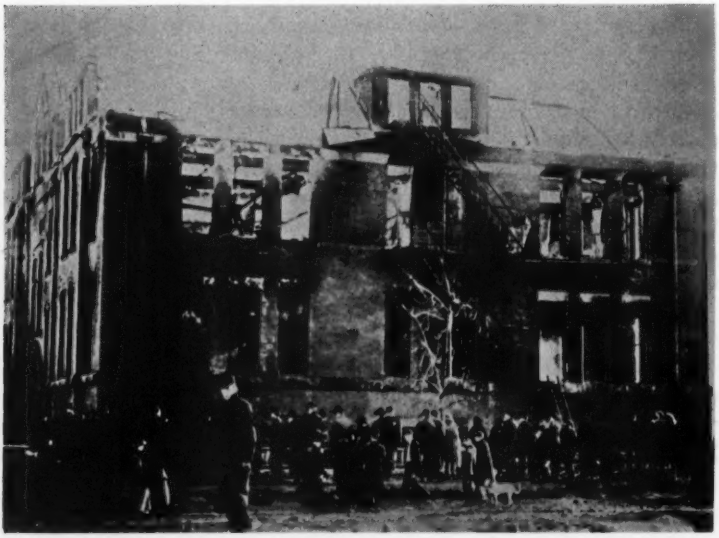
The Lakeview School, Collinwood, a suburb of Cleveland, was destroyed by fire between the hours of ten and eleven o'clock Wednesday morning, March 4, 1908, while school was in session, resulting in a loss of life of two teachers and 173 children.

Smoke was first seen coming through the crevices in the stairway at the front of the building; flames shortly afterward appeared and spread with great rapidity up the stairway to the upper floors. At the discovery of the fire the janitor of the building sounded the school fire alarm gong, and the teachers are said to have immediately given the fire drill signals. Reports indicate that through this means the children in the rooms on the first floor were safely ushered out of the building.

The children on the upper floors, however, in some manner became panic-stricken, and all of them made a mad rush for the rear stairway exit, which with the front stairway exit, separately branched from the main corridor in the center of the building. At the bottom of the rear stairway landing on first floor, a few feet from the outer entrance to building, was a frame partition which created a vestibule between the partition and outer doors. In the mad rush for safety, the children became wedged against the inner side of this partition and were found there, jammed in a heap, by early rescuers on the scene. So tightly were the children wedged that the rescuers could offer but little assistance; consequently they perished at that location. In the meantime, the flames had made great headway, and all attention was directed toward saving the occupants. This, with the absence of individual fire pro-



First floor plan of the Lakeview School of Collinwood, Ohio. The plan shows the open hallway and the one fire escape which saved the lives of most of the pupils on the second floor. The loss of life was caused by a jam in one of the vestibules shown.



Russell Sage Foundation.

Ruins of the Collinwood, Ohio, School after the fire in which one hundred and seventy-three pupils and two teachers were burned to death on March 4, 1908.

tection and total inadequacy and disability of the Collinwood Fire Department, caused the building to be totally destroyed.

The Collinwood schoolhouse was considered a modern building, the construction being of the average school found almost everywhere; the lighting and heating devices were of a modern nature, and apparently were well installed. The building was provided with two separate exits; with an outside fire escape; the school was well disciplined under the fire drill; and all in all, there was really nothing of an unusual nature in connection with the school to lead anyone to the belief that such a horrible catastrophe could really happen. There are hundreds of other schools throughout the country by no means as well constructed or secure against such a loss as was the Collinwood School.

The direct cause of the fire is not positively known, although the conclusion reached by a thorough joint investigation and inquiry made by the Deputy State Fire Marshal, local coroner, chief of Cleveland Fire Department, and members of the Collinwood Board of Education, is that the fire originated from a steam main which rested on wooden joists and was partly concealed about the joists.

Investigation also revealed that in the basement, under the front stairway was a closet which was used for miscellaneous storage purposes. The fact that smoke and fire was seen coming from the stairs directly over this closet, and that the closet was used for all sorts of miscellaneous storage, leads to the theory that the fire may have originated here.

Parochial School, Peabody, Mass., October 28, 1915.

On October 28, 1915, at 9 A.M., a fire was discovered in the basement of the St. John's Parochial School at Peabody, Massachusetts.

This building was ninety-five feet long, located about three hundred fifty feet from the street and partially hidden therefrom by other buildings. It was erected in 1892, was three stories in height, with basement, of second-class construction, with brick walls and wooden interior, plastered walls and ceilings, partitions sheathed and varnished. There was a corridor about eleven feet wide on each floor extending the whole length of the building, and on the three upper floors there were openings off each corridor into six schoolrooms.

There were two stairways opposite each other, descending into and towards the center of the corridor on the first floor. These stairs were five feet wide and were the only means of exit from the upper floors. Under these stairs were entrances to the basement. The stairways on the first floor were about thirty feet apart, and between them was a sheathed partition with double doors which were kept open when the school was in session.

Underwood & Underwood.

St. John's Parochial School, Peabody, Mass., during the fire that took the lives of twenty-two pupils on October 28, 1915.

The school consisted of seventeen sisters in charge and 672 pupils, of whom 300 were on the first floor, 260 on the second and 112 on the third floor, the smaller children being on the first floor.

On the morning of the fire the high school commenced at 8:30 o'clock and the grammar and primary grades at 8:45. The fireman who had care of the heater in the basement had been there to look after his fire, but was absent at the time the fire started. Some of the sisters had been in the basement with their classes just before school, a half hour before the fire was discovered, and at that time there were not any signs of fire. When they went to their classrooms, the doors to the basement were left open, as was the custom.

From five to ten minutes before the fire was discovered, the sister superior passed by one of the basement doors without noticing anything unusual, on her way to the upper floors. When she reached the third floor, she saw a light smoke, but could not tell where it came from. Suspecting fire, she immediately went downstairs to investigate, and saw flames coming up over the stairs at each end of the basement.

Opening a classroom door, she requested the sister to see that all exits were open, and, going quickly to the second floor, rang the bell which was

Underwood & Underwood.

Doorway of St. John's Parochial School where the jam occurred. While the children had been schooled in a fire drill, this did not prevent panic and loss of life when the fire came up the basement stairs and blocked this exit.

the signal for a fire drill, and remained there until the last child had left the upper floors.

It was customary in the fire drills of the school for the boys and some of the girls to go down the back stairs out of the rear door, and the balance of the girls to go down the front stairs and out of the front door. The line was well kept and the children under control until the first floor was reached.

The fire had increased very rapidly after the bell sounded for every one to get in line and leave the building. Some of the girls from the third floor testified that there was hardly any smoke and little flame in the lower corridor at the time they reached it, but this condition rapidly changed to thick smoke and flames at the ends of the corridor near the basement doors, and in consequence there was increased fright, much confusion and a congestion at the front vestibule.

The wind was from the rear part of the building, blowing about nine miles an hour, and as both doors from the basement and the outer doors at each end of the corridor on the first floor were open, the flames, heat and smoke were driven towards the front part of the building.

Whether some girl accidentally fell down in the front vestibule or was struck down by the heat and smoke from the basement, that appeared to be concentrated at this point, it is difficult to ascertain, but after one child fell,

Interior of the first story corridor of the Peabody School after the fire in which twenty-two lives were lost. This photograph is taken from the point where the jam occurred. Fire started in rubbish in the basement, the flame and smoke coming up the basement stairway (2). Children coming down stairways from second story (1 and 4) and those coming through classroom doorway (3) met here and perished.

others fell, until nineteen children were held in this spot by smoke and flames. When the others in the corridor near the entrance to the vestibule saw this condition, they turned back, and either made their escape by the rear exit or entered a classroom off of the corridor and escaped through the windows. In the meantime, some of the sisters had reached the front entrance, and, with the assistance of the janitor, who heard the cry of fire and immediately ran to the front of the building, and some other men who had reached the scene, rescued a number of the children from the front vestibule where they had fallen, keeping at this work until driven away by the intense heat from the basement. Two of the girls rescued died afterwards at the hospital. This all happened before the fire department arrived at the scene of the fire.

An alarm was sent through the telephone to the engine house by a fireman who happened to be at home on account of a day off, and who afterwards hastened to the building and assisted many of the children to escape through the windows.

The cause of this fire is unknown. The corridor that extended through the basement had a sheathed partition on each side. There was a sheathed partition with an opening at the top across the center of the corridor with double doors therein, which were usually kept locked. In this corridor on either side of the partition there were placed two or three wooden barrels

in which to keep the sweepings from the schoolrooms. The contents of these barrels were removed once a week. Under the rear stairs was a closet or bin some five feet wide and ten feet long. Partitions on each side extended only part way to the ceiling. There was a door on the opposite side from the corridor to the closet which was kept locked.

The fire evidently started in the closet or in the barrels kept in the corridor for rubbish, as indicated by the burning at these particular points. There is nothing, however, to indicate how it started, but after it once got headway, with both exits from the basement to the outer air open, it spread very rapidly.

The St. John's School building was a substantial, large and roomy structure, and the egresses were thought to be ample for the number of children who occupied it. Many times at the sound of the bell it had been vacated in a minute and a half. The children were well drilled and disciplined, but they had only been trained to leave the building by the way of the two exits prepared for them, and unfortunately on the day in question this line of march led directly into the corridor where the smoke and fire were pouring. While the egresses provided were all the law required, it now appears evident that there should have been additional exits to those already constructed.

St. Boniface College, Manitoba, November 25, 1922.

This story of the fire at St. Boniface College on November 25, 1922, is based on the report issued by the Provincial Fire Commissioner together with some information from other sources.

The burned building was owned by Le Corporation du College de St. Boniface and stood in large grounds, about 22 acres, in the City of St. Boniface. It was about 290 feet long and from 60 to 90 feet wide.

It had brick walls to a height of three stories and a mansard roof formed a 4th story. There was only a partial basement. The building had been enlarged and the old brick walls were left, but large openings were made and a corridor ran the length of the building on each floor. The stairways were open. One connecting all floors was in a brick tower, but with wood and glass doors. The interior was in part of joist construction with cast iron columns; interior finish was lath and plaster, metal and wood; there was a large amount of varnished woodwork in the trim and partitions. Heating was by steam and lighting by electricity, open wiring. There were two fire escapes of the sliding pole type with balconies on each floor.

At the time of the fire there were 154 students, all boys from 9 to 18 years of age, and 41 members of the staff sleeping in the building; most of the students slept in dormitories on the 4th floor.

Underwood & Underwood.

Nine students and one teacher lost their lives in this night fire in St. Boniface College in Manitoba on November 25, 1922. There was no fire drill. Fire escapes were inaccessible and the dead are supposed to have lost their way in the smoke-filled building.

The fire was discovered about 2:15 A.M. by the Father Prefect, who was awakened by the sound of an explosion and falling glass. On going out to the corridor he saw flames in the eastern part of the building and immediately rang a hand bell; he then tried to call the fire department by telephone but could not see the numbers on the dial, it being an automatic telephone. Another member of the staff then ran to the fire station, about 1600 feet distant, though there was a public fire alarm box about 350 feet from the building.

Meanwhile the occupants of the building were making their escape. They got out in various ways. Most of the boys in the dormitories appear to have used the fire escapes, five were taken down ladders after the arrival of the fire department, but 9 boys and one member of the staff lost their lives and a few others were injured.

The cause of the fire is unknown; after a thorough investigation the Fire Commissioner came to the conclusion that it was caused by smoking in a lavatory situated about the point where the fire appears to have started. An entertainment had been given in the recreation room on the evening before the fire and some of the boys requested permission to smoke. This had been refused, but it was shown in evidence that there was some smoking, and it is thought that a cigarette may have been dropped in a concealed space and smouldered for a time before breaking out.

Ruins of the St. Boniface College, showing the character of the construction. Brick walls gave the semblance of fire safety and a false sense of security.

This is only another case where the fire hazard was ignored in the construction of the building, and the result was a deplorable loss of life and property. The contents included a valuable library containing old records and documents that cannot be replaced. When the building was extended the old walls could, at small cost, have been made good fire walls dividing the building into three sections. Instead of this, large openings were cut in them. The stairways could have been enclosed sufficiently to check the spread of fire and smoke, giving the occupants a better chance to escape. The brick stair tower would have been a useful means of escape if it had been provided with fire doors, but the doors were wood with glass panels and the tower served only as a flue.

The public protection in St. Boniface was quite inadequate for a large fire. As there were no hydrants in the college grounds, long lines of hose were needed for the five or six feeble streams that were used. In this case it probably made little difference, as the fire had a good hold when discovered, and owing to the construction of the building it swept through with such rapidity that it would have been practically impossible to control.

No fire drills had ever been held. If the students had been drilled, there might have been less confusion and the loss of life might have been avoided.

Cleveland School, Camden, S. C., May 17, 1923.

On the evening of May 17, 1923, while a play was being presented by the children as a part of the commencement exercises, fire broke out in the auditorium of the Cleveland district school. Twenty minutes later only ruins remained and seventy-seven people had perished in the flames.

The schoolhouse was a two-story frame building with a tin roof and ceiled with wood on the inside. The building was 100 feet long by 34 feet wide, with two classrooms and two cloak rooms on the first floor and the auditorium on the second floor, the latter being used also as a classroom during school hours. These rooms were used by three teachers who taught a rural grade school from first to tenth grade.

At one end of the auditorium a wooden platform had been raised eighteen inches above the floor to serve as a stage. Against the left hand wall of the building, facing the stage, was a wooden stairway leading from the cloak room on that side and opening into the auditorium at a point about halfway from the end of the building. This stairway was completely boarded up on either side from the cloak room to the second floor; the well hole opening to the stair shaft was protected at the second floor on one side by a hand rail about three feet above the floor, and the space between the hand rail and the floor was boarded up to prevent pupils falling from that side into the stair well. At a point between 24 and 30 inches above the cloak room floor, the stairs from the auditorium, fourteen or fifteen steps in number, and having a width variously estimated at from 30 to 36 inches, came to an end on a landing three feet in width, but instead of continuing their full width to the landing, a door frame intervened at this point, thus creating an off-set on each side of the stairs, and this proved the most fatal defect in the construction. From the landing, three more steps led down to the cloak room floor. From this point, a person descending would turn at right angles to the left and pass out of the cloak room door into the vestibule of the school and another right angle turn to the right led through the main door into the open.

The school was lighted by metal lamps of the Argand burner type, suspended by their bails from hooks in the ceiling. The first floor of the building was raised on brick piers to a distance of about twenty-four inches above the ground. The ceilings of the ground floor were about eleven feet high, and allowing 2½ feet for the height of window sills above the floor in the auditorium, it appears that the total distance from the sills of the auditorium windows to the ground was approximately fifteen feet.

On the evening set for commencement exercises, the auditorium was filled to capacity by relatives and friends of the children from a large part of the county, the number of those present being between two and three hundred. The stage had been curtained off at each side with burlap to

Seventy-seven deaths occurred when the Cleveland District School, Camden, South Carolina, was destroyed by fire on May 17, 1923. This picture shows all that was left of the school building. A searching party is looking for bodies.

form dressing rooms and a metal oil lamp was suspended from a hook set in the ceiling above the stage to furnish light. While the play was in progress, one of the audience observed that the wood ceiling just above the lamp had ignited and was burning. Cautioning the lady beside whom he was sitting to make no outcry, he started toward the stage to extinguish the fire before anyone else should notice it and start a panic. Before he could reach the stage, however, the hook from which the lamp was suspended pulled out and the lamp fell to the stage. Some of the men attempted to extinguish the burning oil with a rug and with the curtains on the stage, which they tore from their fastenings, but the fire spread too rapidly for them to get it under control, quickly igniting some of the curtains and flashing across the stage.

A panic quickly followed and the maddened crowd rushed wildly for the one small stairway. Some got through to the open before the jam occurred at the doorway opening from the stairs to the cloakroom landing. This jam had been largely due to parents dropping their children over the auditorium rail on to the stairway below. Added to this, many of those who had escaped in the first blind rush came to a realization that they had left behind them members of their families to perish in the flames and attempted

The grave for sixty or more of the victims of the South Carolina district school fire. This grave measured ten feet by forty feet. Most of the bodies were buried in this common grave, as they could not be identified.

to force their way back into the building up this same narrow stairway to save them. The result was two opposite streams of humanity trying to force their way over a stairway all too small at the best, and the ensuing jam became unbreakable. The bodies were so interlaced at the doorway that three strong men from the outside seizing the living while yet in a standing position were unable to budge them and they were left in full consciousness of their fate, to perish in the advancing flames.

The net result of this terrible holocaust was seventy-seven dead, of which several bodies were completely consumed and others were so badly burned that only two were recognizable by their appearance after the fire. The greater number died from suffocation before the flames reached them, but some of those who perished could only wait in full consciousness until the flames should reach them and end their agony. Two entire families were wiped out of existence,—one a widower with three girls and one little boy, and the other consisting of father, mother and one child. One lady in Camden was said to be related to 43 of those that died and there was barely a family in the town of Camden not affected.

The potential cause of this fire was, as is so frequently the case, carelessness—an oil lamp having sufficient burner capacity to throw off through

the chimney heated gases, as the products of combustion, of considerable intensity, and this lamp suspended from a metal hook set into a wood ceiling without suitable protection. Naturally after the wood above the lamp chimney had been subjected to this heat for a sufficient length of time, the fibers became charred and the weight of the lamp was such as to pull out the hook. What followed was to have been expected.

A single exit, and that of a thoroughly combustible nature, for buildings of more than one story in height is too palpably wrong to even admit of comment, especially when such stairway is the means of egress and exit to and from a room where any considerable number of people congregate, but in this case, the most grievous mistake lay in constructing a doorway at the point where these stairs opened on to the cloakroom landing, thus creating an offset on either side. One of the fundamental recommendations in connection with exit facilities is that the stairs shall be continued full width to the street or other open space where safety is to be found.

Hope Development School, Playa del Rey, Calif., May 31, 1924.

On the evening of May 31, 1924, about 8:45 P.M., fire was discovered in the Hope Development School, at Playa del Rey, near Venice, California. As the result of this fire the matron and twenty-three of the forty-one girls at the school lost their lives. The matron gave her life attempting to save her wards. All of those rescued were led or carried to safety by the assistant matron.

This was a privately operated school for subnormal girls, although county wards were inmates at the time. One of the girls confined at the home has made a statement admitting that she started the fire for the purpose of getting away from the place. This may or may not be true in view of her mental condition.

Previous to the time of the fire all of those in the building, except the assistant matron, who was reading in her room upstairs, had retired, and the fire was discovered simultaneously from the outside by a disabled soldier who was a camper on the beach, and the attendant at an oil station across the street. The soldier drove to the building in his machine, gave the alarm with a police whistle, and attempted to rescue the inmates, but because of the speed with which the fire spread this was impossible, so he drove to fire headquarters, which is the nearest fire station, about two and one-half miles away, to give the alarm. In doing this he passed five fire alarm boxes, one of which is within two blocks of the school building.

This building was of frame construction, about 60 by 80 feet, two stories with small basement which opened out on the beach, and was built about

Ruins of the Hope Development School, Playa del Rey, California. Twenty-three girls and a matron were burned to death here on May 31, 1924. This building was notorious as a fire trap. The children were cremated in their beds.

1900. It was originally planned for a hotel, but had been vacant for many years. About three years before it had been leased and the lessor established the school. The proprietor of the school was absent at the time searching for a safe place to house the girls. Housing conditions in Southern California played their part in the tragedy. Fire Chief Geo. A. Hubbard, of Venice, had inspected the place from time to time, realized the danger, and, while he had no authority to condemn it, had personally taken fire extinguishers into the building, placing them on the walls.

The usual reports about the inmates, girls ranging in age from five to twenty-five, being locked in their rooms and strapped into their beds, were circulated. These reports have not been verified. The investigation disclosed the fact that in most cases the girls had not left their beds, this being shown by the uncharred portion of their clothing on their backs which had been protected by the bed.

On the arrival of the first fire company the men found the entire building enveloped in flames and by the time they had taken suction the northeast and south walls, as well as the roof, were falling in. Two fire engine companies worked at the fire with four lines of 2½ inch hose. The lives had been lost and the building destroyed before the arrival of the fire department. As soon as the burning ruins had cooled off so as to permit doing so, search was started for the bodies. The firemen knew there would be loss of life when they left their stations to answer this call.

There is nothing unusual about this fire. On the contrary this is just the kind of thing that is expected to happen where people are housed in numbers in that type of building and under such conditions.

Rural School, Babbs Switch, Oklahoma, Dec. 24, 1924.

Another chapter was added on Christmas Eve, 1924, to the already long story of schoolhouse tragedies. Thirty-six people lost their lives when flames swept the rural school at Babbs Switch, near Hobart, Oklahoma. Eighteen of the victims were children.

The building was a small one-story frame structure housing a single schoolroom. It had two doors, both of which opened in. One of these was entirely blocked by a built-in coal bin. The seven windows were heavily barred, the bars having been installed to prevent tramps getting into the building when it was unoccupied.

At the time of the fire some 150 people were crowded into the one room attending a Christmas entertainment. A Christmas tree was provided, decorated with tinsel and lighted with small wax candles. The tree was set in the southeast corner of the room, insecurely fastened to the floor, and toppled over once while being trimmed. It was again righted and fastened in the same manner.

This building is exactly like the Babbs Switch school in which 36 people were burned to death, on December 24, 1924. The building shown is two miles from the one which burned. The two schools were built at the same time, from the same plans. Over 150 persons were jammed into the building for the Christmas tree celebration. Men, women and children piled their bodies against the one door and were burned to death. At the extreme right is the cloak room and entrance to the school, the door opening inward. At the left is a garage for the teacher's car.

The charred bodies of some of the child victims of the Babbs Switch school fire resting in the morgue at Hobart, Oklahoma, pending identification.

Following the entertainment, a man dressed to represent Santa Claus entered the building.

He distributed candy and presents which were laid on the floor around the tree and then proceeded to strip the tree of presents that had been placed thereon.

About nine-thirty o'clock Santa Claus, in reaching for a present near the top of the tree, pulled down a branch which came in contact with a lighted candle. The branch, decorated with cotton and tinsel, was immediately ignited, when Santa Claus endeavored to reach it but was unable to do so. At this point some persons in the audience jokingly cautioned Santa Claus to look out or he would get burned. Santa Claus then picked up a small toy chair, threw it at the burning branch and in so doing knocked over a glass bowl kerosene lamp sitting on the table near the tree which immediately exploded.

Instantly the crowd stampeded for the door. Santa Claus, in the meantime, endeavored to smother the flame with a coat, and not being successful grasped a cotton curtain which had been used as a stage curtain. In his excitement he knocked the tree over, his clothing caught fire and in an instant he was a mass of flames.

When the blaze reached the ceiling, which had been recently well painted with white oil paint, the fire flashed over the entire surface.

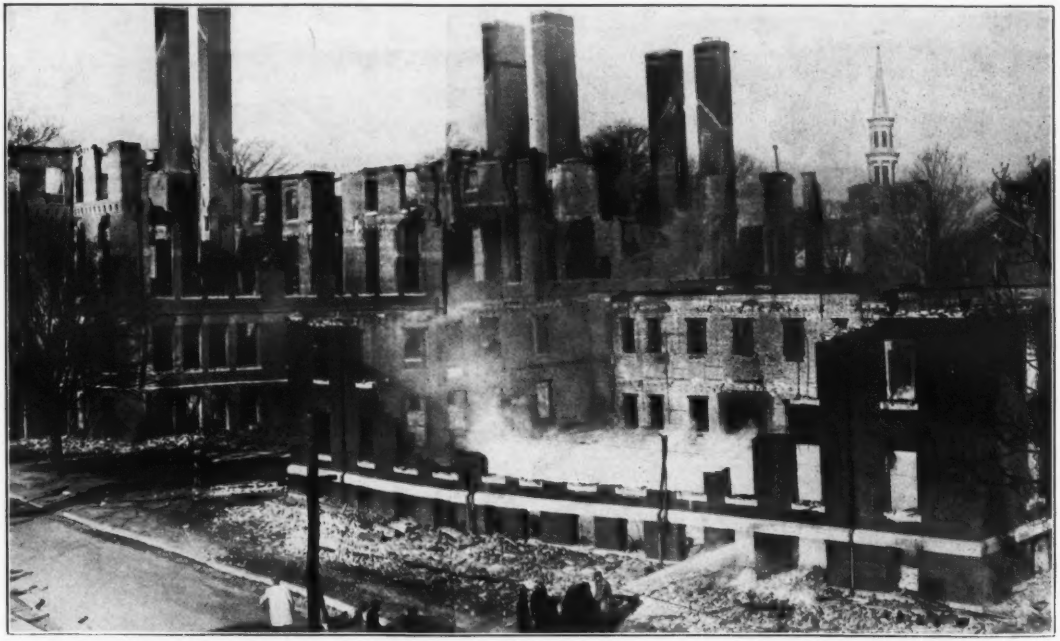
Some of those who had escaped through the narrow doorway endeavored to re-enter the building with the intention of rescuing relatives or friends, which caused a complete blocking of the only exit. Outsiders endeavored to tear the window screens from their fastenings but could not do so; however, the corner of one of the screens was loosened and one small boy was rescued through this opening.

About twelve minutes after the fire started the building collapsed. Eye witnesses state that two minutes after the tree toppled over, the building was a veritable charnel house. As is usual in such cases, the wildest excitement prevailed and no doubt many were trampled to death before being burned.

The teacher had at some previous time instructed her pupils, that in case of fire they should try to get out of the building by crawling along the floor toward the door. If any of the children tried to follow this advice, they were certainly killed.

Thirty-three bodies were removed from the ruins and three of the injured died later, making a total of thirty-six deaths, of which eighteen were children under eighteen years of age and eighteen grown people. In addition, forty persons, injured and burned, were taken to hospitals. Twenty of the unfortunate victims were buried in one grave, as the bodies could not be identified.

Nearly every condition favorable to fire and loss of life was present. The building was a frame tinderbox; lighted candles were placed on a very flammable and insecurely mounted tree; kerosene bowl lights on tables were the only illumination; the building was crowded beyond its capacity; one doorway was blocked up by a coal bin, the other opened inward and was difficult to open, and windows were effectively barred; there was not even a fire pail, and the fire was undoubtedly spread when attacked in its incipiency by wraps and bare hands; those who escaped from the building had to stand by and see the fire burn unhindered, there being no semblance of a water supply or fire apparatus in the vicinity.



Ruins of the State Normal School, Bridgewater, Mass., destroyed by fire December 10, 1924, with a loss of over one million dollars. Only good fortune prevented loss of life among three hundred girl students who were asleep when the fire started. There was practically no water available for fire protection. The serious lack of water had long been recognized, but the state authorities, the water company and the town each had looked to the others to act, and nothing was done. Had there been a good water supply the fire could have been quickly extinguished.

Loss of Life in School Fires.

In compiling the fire record of schools printed on page 173 there were found to be thirty fires in which loss of life occurred. These fires include the well-known school holocausts as well as numerous fires in which only a few people were killed. It is by no means a complete list, but includes enough fires to permit generalization as to the factors causing these losses of life. A number of fires are included in which employees or firemen, rather than children, were the victims. The number of recorded deaths among those fighting school fires is far greater than in other similar occupancies, perhaps because of a zeal in fire fighting due to a special sense of responsibility for the safety of schools. The list of fires classified by occupancy, using the classifications chosen in discussing the general fire record of schools in this issue, follows:

High Schools.

Northside High School, Minneapolis, Minn., June 18, 1913. Two firemen killed by falling walls.

High School, Wheeling, W. Va., January 3, 1914. Two volunteer firemen killed by falling walls.

Deering High School, Portland, Me., May 21, 1921. Fire Captain killed by falling wall.

High School, Marlboro, Mass., June 22, 1922. Girl burned to death when sparkler ignited her clothing.

Washington High School, Portland, Ore., October 25, 1922. Fireman killed by falling wall.

English High School, Lynn, Mass., March 29, 1924. Fireman killed by falling beam.

High School, University City, Mo., September 21, 1926. Workman killed when solvents of a plastic floor covering exploded.

Elementary Schools.

Hochelaga School, Montreal, P. Q., February 26, 1907. Teacher and nine children trapped in building and burned to death.

Public School, Monterey, Ind., December 27, 1907. The explosion of a gasoline lamp ignited the clothing of two little girls, who were burned to death.

Lakeview School, Collinwood, Ohio, March 4, 1908. Jammed exit trapped two teachers and 173 pupils in building. All were killed.

St. John's Parochial School, Peabody, Mass., October 28, 1915. Twenty-two pupils burned to death as fire, coming up basement stairs, cut off their exit.

Negro School, Asheville, N. C., November 16, 1917. Seven children who reëntered building to save clothing burned to death.

High Point Community School, Covington, Ga., November 28, 1922. Two of pupils trapped on second floor were burned to death.

Cleveland School, Camden, S. C., May 17, 1923. Panic, following the fall of a lamp in an assembly room, caused a jam on the one stairway. Seventy-seven people, forty-one of whom were children, perished.

The Christian Brothers College, St. Louis, destroyed by fire on October 5, 1916. The fire started on the fourth floor of this five-story brick joisted building and caused the death of nine men.

Rural School, Babbs Switch, Oklahoma, December 24, 1924. Thirty-six people killed in rush for the only door.

Dormitory Buildings.

University Building, Nashville, Tenn., December 18, 1903. Fifteen girls killed in night fire.

Fraternity House, Ithaca, N. Y., December 7, 1906. Three students and three volunteer firemen killed.

Fraternity House, Ithaca, N. Y., January 31, 1908. One student killed.

Christian Brothers College, St. Louis, Mo., October 5, 1916. Nine men perished.

Settlement School, Pine Mountain, Ky., January 24, 1919. One woman and four boys killed in night fire.

Piedmont College, Demorest, Ga., January 21, 1920. A girl, who attempted to save her clothing, was burned to death.

Convent, Wilkesbarre, Pa., March 21, 1920. One nun killed in jump from window.

St. Boniface College, Winnipeg, Man., November 25, 1922. Nine boys and one man, sleeping in dormitory, killed.

Fraternity House, Waterville, Me., December 4, 1922. Four students died in night fire.

Hall School for Girls, Pittsfield, Mass., February 17, 1923. A servant was burned to death.

Normal and Industrial Institute, Utica, Miss., November 6, 1923. Two boys, while attempting salvage, trapped on an upper floor and burned to death.

Convent, La Crosse, Wis., December 2, 1923. One nun trapped in a daytime fire and burned to death.

Hope Development School, Playa del Rey, California, May 31, 1924. Matron and 23 feeble-minded girls burned in their beds.

Mission School, Umatilla Indian Reservation, Oregon, April 21, 1926. Nun killed in jump from window.

Ely Court Boarding School for Girls, Greenwich, Conn., December 23, 1926. Employee burned to death while attempting salvage.

Laboratory Building.

Medical Building, U. of Missouri, Columbia, Mo., April 10, 1920. A thief lit a match in a room used to store alcohol and ether. He died from burns received from the flash which followed.

The tables which follow summarize the causes of the loss of life rather than the cause of the fire. The tables follow the general plan used in the Loss of Life Fire Record (*Quarterly,* Vol. 18, No. 3, Page 296) and the Fire Record of Loss of Life in Dwellings (*Quarterly,* Vol. 20, No. 4, Page 385). Thus a fatality due to a fire originating in rubbish in a basement would, depending on the circumstances, be classed as "suffocation while asleep" or "inadequate exits" rather than as due to rubbish. Where direct fire causes are cited as causes of fatalities, this means that the loss of life was due to burns or ignition of clothing by the originating cause of the fire. The tables are thus prepared on an entirely different basis from the usual fire record tables.

The loss of life per fire is high, 14.1 persons. This is swelled by the several holocausts included in this record, and by the fact that the record is not complete. This figure is much higher than the figure of 2 per fire in dwellings or the figure of 6 per fire in other occupancies, as shown by the previously compiled loss of life fire records.

Loss of Life in School Fires.

Number of fires in which lives were lost..... 30

	Number	Per Cent
Men killed	47	12.0
Women killed	39	10.0
Children killed	314	78.0
	400	100.0
No data as to sex or age	23	

Total number of lives lost.....423
Loss of life per fire included in this record 14.1
Number of injuries recorded in these fires.....100

The number of injuries recorded includes only those stated in the reports. In many cases no statement of injuries was made, and the actual number of injured is obviously much greater than 100.

The following tables are for the most part self-explanatory. In high schools there have been no serious disasters, the loss of life in high school fires being almost entirely in connection with fighting the fire. It is in the

Causes of Loss of Life in School Fires.

Fatalities classified according to the immediate cause of the loss of life rather than according to the cause of the fire.

	Number of Deaths.					
	High	Elementary	Classroom Buildings	Dormitories	Shops and Laboratories	Total
Construction.						
Fatalities which would have been prevented by superior construction. Cases where loss of life is due to failure to escape from a burning building, whatever the primary cause of fire, are classified under construction.						
Inadequate exits	—	252	—	—	—	252
Exit doors open in, barred windows	—	36	—	—	—	36
Night fire, people asleep, no data as to just how deaths were caused	—	—	—	35	—	35
Suffocated while asleep	—	—	—	27	—	27
Fire coming up basement stair, cuts off exit	—	22	—	—	—	22
Fire from first floor, cuts off stair to second	—	12	—	—	—	12
Attempt to descend inside stairs	—	—	—	3	—	3
Total						387
Burns and Ignition of Clothing.						
Classified in accordance with the direct cause of death, including cases where the victim died of burns, irrespective of whether or not the building was ignited.						
Gasoline lamp explodes	—	2	—	—	—	2
Sparkler ignites clothing	1	—	—	—	—	1
Total						3
Fire Fighting and Salvage.						
Fatalities resulting from remaining in buildings to fight fires which were beyond control, or from entering burning buildings in ill-advised attempts to save valuables.						
Re-entering burning building	—	7	—	4	—	11
Collapse of building or part	7	—	—	—	—	7
Fire fighting, no other data	—	—	—	3	—	3
Total						21
Special Hazards.						
Explosion of plastic floor solvent	1	—	—	—	—	1
Explosion of flammable vapors	—	—	—	—	1	1
Total						2
Miscellaneous.						
No data	—	—	—	10	—	10
Grand total	9	331	—	82	1	423

elementary schools, both public and parochial, that the great disasters have occurred. Practically all these have been due to the lack of adequate or properly arranged exits. In cases where there was more than one exit available the arrangement was often such that the fire cut off both exits. In other cases pupils went down stairs to meet fire coming up, and the press of those behind prevented retreat. In two of the major disasters, the building was being used as a place of assembly, adults and friends of pupils unfamiliar with the exits, being present.

In dormitory fires most of the loss of life resulted from the fire starting at night while the occupants were asleep. Ill-advised attempts at salvage were the cause of numerous losses of life in elementary school building and dormitory fires.

Loss of Life in School Fires by Occupancy.

			Lives Lost.				
	Total Fires	Total No.	Men	Women	Children	No Data	Injuries (Where stated)
High schools	7	9	8	—	1	—	27
Elementary schools	8	331	16	18	274	23	58
Classroom buildings	—	—	—	—	—	—	—
Dormitories	14	82	22	21	39	—	14
Shops and laboratories	1	1	1	—	—	—	1
	30	423	47	39	314	23	100

Other Loss of Life School Fires.

High Schools.

Deering High School, Portland, Me., May 21, 1921. The fire was discovered at about 4:17 A.M., destroying the roof and upper floor of the building and causing a loss of about $100,000. Five firemen were injured when the roof collapsed, one of them dying later from injuries thus received.

The building was a three-story and basement brick construction, the interior being largely wooden. The fire originated, as far as can be determined, in an engineer's closet containing clothing and personal belongings. The fire spread up to a blind attic, where a smoke explosion occurred, causing the collapse that was fatal to a fire captain.

English High School, Lynn, Mass., March 29, 1924. Fire which started from an unknown cause in the basement, shortly after midnight, totally destroyed the main or original building of this school group, with a property loss estimated at about $750,000, and caused the death of one fireman and the injury of several others before it was extinguished.

A large addition to the main building was saved by a substandard fire wall with door openings protected by fire doors. In this addition, however, there occurred a serious hot air explosion which caused considerable damage

Interior of the Deering High School, Portland, Maine, after fire of May 21, 1921. This fire, which started in a closet used by the janitor to store personal belongings, caused the loss of one life. The photograph shows the type of wooden interior construction which was responsible for the rapid spread of fire through the building.

to the plaster sheathing in the top floor and dislodged part of the cornice on the side wall, the falling bricks from this cornice being the cause of the death and injury to firemen.

During the height of the fire, a heavy rain storm occurred, which undoubtedly prevented a conflagration in the center of the city, as brands from the fire were spread over a large area of mercantile and dwelling houses where shingle roofs predominate.

From available evidence, the fire started in the waste paper baling room in the basement, located just at the right of the entrance to the building. The fire extended from here through the numerous open spaces back of the partitions, directly into the large open attic; also to the main corridor in the basement, where it spread unobstructed up the large open stairways to all parts of the front section, and into the rear portion.

The principal factor in the total destruction of this large school may be attributed to vertical openings in the nature of large open stairways, large hollow spaces back of wall sheathing connecting the basement with the large open attic and a network of metal ventilating ducts.

The installation of an automatic sprinkler system, at least in the basement of this building, provided openings into the first floor were properly protected, would undoubtedly have prevented this serious loss.

While it is a fact that the substandard double swing fire doors were a factor in checking the spread of fire into the additions, it is to be noted that it was through these doors that the hot air and smoke entered the James Street Addition, resulting in the hot air explosion. Standard double fire doors at this important cut-off would undoubtedly have prevented this explosion and not have required the support of hose streams at this point.

Elementary Schools.

HOCHELAGA SCHOOL, MONTREAL, P. Q., FEBRUARY 26, 1907. This was a day school. The building was two stories in height, of wood joisted interior construction. The second story was occupied as a kindergarten. The building was divided by a brick wall. There was one stairway, 4 feet wide. A wooden flue (waste paper chute) extended from the basement to the roof and opened into one of the dressing rooms. The fire occurred in the afternoon, while the school was in session, and, as reported, burned for some time in the concealed spaces between the ceiling and the floor before it was discovered. The smoke made the stairway impassable, and rescues were made by the firemen through the windows. Several ladders that were raised to the windows caught fire and could not be used. The teacher remained in the building to hand the children to the firemen and lost her life; nine of the children also lost their lives. The building was damaged but little by the fire. The waste paper chute was found badly charred, and the belief was that the fire started in it. A smoke explosion occurred shortly after the fire was discovered.

NEGRO SCHOOL, ASHEVILLE, N. C., NOVEMBER 16, 1917. Fire started in the boiler room from unknown cause while the school was in session. The janitor was absent, and the fire had made considerable headway before discovered. The pupils were all removed from the building, but a check-up later showed seven missing. These are supposed to have re-entered the building to get clothing and were caught in the flames, which spread rapidly. The building was of ordinary brick and wood construction.

HIGH POINT SCHOOL, COVINGTON, GA., NOVEMBER 28, 1922. Two children were burned to death and thirty injured in this fire, which destroyed the school building. The children who lost their lives were, with forty others, trapped on the second floor of the building when their exit was cut off by the fire which started on the first floor, and many of those who escaped with their lives were seriously burned before jumping to safety. Those who were not burned received fractured legs and arms. The teacher who had charge of the pupils on the upper floor was so severely burned in directing the escape of the children, that fears were expressed for her life. When it was discovered that fire had cut off their only means of safe exit, the teacher

The Lynn, Mass., English High School which was destroyed by fire on March 29, 1924, with the loss of one life. Thousands of schools of this type of construction may be found throughout the United States and Canada.

gathered the children about the windows and directed them in jumping to safety until all but two were out of the building. She then jumped through the flames, being seriously burned. The two children who were burned to death went down in the flames as the floor collapsed. They were boys of six and eight years.

A funeral party passing the school discovered smoke pouring from all windows. The procession to the cemetery was halted, the hearse being sent ahead. The men and women of the party rushed into the building and saved many children on the first floor, but were unable to ascend the stairs on account of the flames. The building was a two-story frame structure. County and school authorities say that the building had been condemned more than a year previously as a fire trap.

Dormitories.

UNIVERSITY BUILDING, NASHVILLE, TENN., DECEMBER 18, 1903. This fire occurred in a four-story brick building, about 35 years old, occupied as laboratory and dormitory. Fire started at about 11 P.M., possibly from

Vertical openings were responsible for the rapid spread of this fire in the Lynn, Mass., High School. Fifteen pumping engines backed up by plenty of water were unable to prevent the total destruction of the main building.

spontaneous ignition in the laboratory. It was discovered by a policeman, who sent in an alarm from a public fire alarm box. About 15 girls were killed or injured fatally. The flames had made considerable headway before they were discovered, and the firemen arrived too late to rescue the girls from the burning building, which was gutted in about an hour. There were no fire escapes.

FRATERNITY HOUSE, WATERVILLE, ME., DECEMBER 4, 1922. Four students at Colby College lost their lives in a fire which destroyed an old brick dormitory. The building burned very rapidly and as the sleeping quarters of the men were on the third and fourth floors but little opportunity was given them to escape. A student coming in on a train at 3 A.M. first saw the fire and entered the building, giving the alarm on each floor and escaping by the fire escape. Many of the men reached a fire escape which led to safety. One of the men tried to go down the stairs, but lost his life. The other three men that were burned to death apparently were not aroused in time to make escape possible. The exact cause of the fire was undetermined, as the structure was completely destroyed.

GIRLS' BOARDING SCHOOL, PITTSFIELD, MASS., FEBRUARY 17, 1923. A fire which destroyed five connecting frame buildings of a girls' school cost the life of one woman. The cause of the fire was the clogging of soft coal soot in a chimney. Sixty-seven students in a large room escaped through the

windows. The ceiling of the room fell five minutes later. A waitress, who was ill in her room, lost her way in the smoke-filled corridors and was burned to death.

NORMAL AND INDUSTRIAL INSTITUTE, UTICA, MISS., NOVEMBER 6, 1923. A fire occurred at 11:30 P.M. in this school for colored boys. The building was constructed of hollow concrete blocks. It measured 66 x 100 feet, three stories high, with an open stairway to the third floor. There was no outside fire escape or outside fire protection. The trustees considered the building entirely safe, as a watchman was continually on duty on the lookout for fires and the doors at the entrances were kept open at all times. The electric lighting was safely installed and the current turned off some time before the fire.

The fire was discovered by a 17-year-old boy who was detailed to act as watchman. He saw the window sill of one of the upper rooms on fire and immediately rang the fire bell and called out the alarm and proceeded to take his trunk out. He stated that by this time most of the boys were leaving, saving their personal effects. The room in which the fire was discovered was used to store athletic supplies, and was always kept locked. No one had been in this room for twenty-four hours preceding. Directly through this room the chimney of the heating plant, which was an unlined concrete block affair, passed out to the roof, the room being on the third floor. The fire was undoubtedly due to the splitting of this chimney.

There was no fire protection of any kind in the building and the fire gained rapid headway. It lasted only forty-five minutes and left only the broken walls and ornamental front. Some of the boys who were engaged in saving their property had to jump from the third story to some mattresses which had previously been thrown from the windows. Several were injured in this way. Two boys lost their lives. Both boys had been seen by others on the second floor of the building and had evidently returned to the third floor to save belongings of others or possibly their own. One body was discovered in the ashes beside the trunk belonging to another boy. The other body was found in the basement. The boy had evidently been overcome by smoke on the stairway.

CONVENT, SOUTH LA CROSSE, WIS., DECEMBER 2, 1923. This fire destroyed a part of the convent of St. Rose, a group of brick and wood buildings. One sister was trapped in her room and overcome with smoke.

GIRLS' BOARDING SCHOOL, GREENWICH, CONN., DECEMBER 23, 1926. A fire, which is thought to have started from a spark lighting on the wood shingle roof at the time the fires were banked, caused the death of one man. Some of the employees of near-by estates were trying to save some of the furnishings and valuable works of art and one of them was trapped in a lower floor and was burned to death.

Fire Record of Schools.

The files of the Department of Fire Record of the National Fire Protection Association contain reports on five hundred and twenty-four school fires, including buildings of all classes used for educational purposes. Most of the fires occurred in the last decade—only about fifty of the fires recorded having dates earlier than 1917, the earliest fire among them occurring in 1903.

The record is by no means complete and does not include many of the small fires which are occurring daily in school properties. The reports from insurance inspection organizations, which are the principal source of data on fires in industrial properties, are found in comparatively small number in the school fire record classification. This may be because of the large extent to which public school property is uninsured or because the money losses involved are not of sufficient interest to the insurance organizations to justify the expense of investigation and the preparation of detailed reports. Many of the reports are based on newspaper accounts which have been verified by local N.F.P.A. members. Insurance inspection bureau reports are, however, the source of data on a majority of the private school and college fires.

In view of the character of the original data, which include the larger and more important fires but not a fair proportion of the smaller fires, this record may not be completely representative. The record, however, includes a sufficiently broad selection of the important school fires of the past decade so that there can be no question as to the validity of conclusions drawn in the tables here.

Nearly every kind of school is included in this record. The following is the number of fires in the record of each type of school:

Kind of School.	No. Fires
Colleges or universities	157
Normal schools	15
Boarding schools	54
Trade schools	32
Business schools	5
Convents	6
High schools	97
Junior high schools	8
Public elementary schools	132
Parochial elementary schools	17
Reform school	1
	524

This indicates a considerable variety available for study. It is apparent, however, that certain types of schools have similar fire hazards and, for purposes of study, may be grouped together. High and elementary public schools are usually housed in buildings used for no other purpose, where the buildings, even in the city, frequently occupy a position relatively isolated from other buildings. Parochial schools and convents are frequently in or adjacent to other church property. Business schools are often in mercantile or office buildings, as are some trade schools. Boarding schools range from the small private school where living and classrooms are all under a single roof to the large academy type of institution which has a group of buildings comparable to a university or college property.

It is the building and the character of its occupancy which is important rather than the kind of school. A building used as a dormitory has the same hazard regardless of whether it is part of a university, private boarding school, normal or trade school or convent. A building used for classrooms, laboratories, etc., is as hazardous as a part of a university as if a part of a private school. While the fire hazard of public high and elementary schools is not very much different from that of other types of school, they have distinct characteristics of occupancy, etc., that justify considering them separately.

The fires in this record are grouped as follows for purposes of study:

Classification of Buildings in Which Fire Occurred.

	No. Fires
High school buildings	105
Elementary school buildings	149
Classroom and office buildings of private schools and universities	54
Dormitories	109
Workshop and laboratory buildings	47
Miscellaneous buildings	60
	524

The classification High School Buildings includes the few junior high schools which are essentially the same in character as high schools. High schools are considered somewhat more hazardous than elementary schools because of the chemical laboratories, domestic science and manual training rooms they contain. The elementary school classification contains fires in 132 public and 17 parochial schools. These elementary schools are for the most part buildings devoted entirely to classrooms and have a relatively lower potential hazard than other schools.

It was found impossible to tell from most of the reports of fires in dormitory buildings whether or not the building was solely used as students' quarters, and so in this classification "Dormitories" includes numerous buildings used as dormitories and also for classroom and laboratory purposes as well. As nearly as could be determined from the reports in 77 cases, the

building was used only as a dormitory, in 23 cases it was certain that the building contained classrooms, and in a few cases laboratories. This classification embraces dormitories attached to all kinds of schools: universities, colleges, normal schools, trade schools, private boarding schools and convents.

The classification "Workshop and Laboratory Buildings" includes 15 buildings devoted to woodworking, metal making and other kinds of shops, and 32 buildings housing laboratories primarily—as buildings at technical and textile schools, colleges and universities.

Under the heading miscellaneous fall all buildings not otherwise classified. These include the following as well as 18 cases in which there were not enough data given to permit classification.

Occupancy	No. Fires
Stores and offices	11
Power plant	7
Gymnasium	6
Church	5
Dwelling	3
Hospital	2
Shed	2
Armory	1
Library	1
Icehouse	1
Stable	1
Garage	1
Theatre	1
Total	42

The table on the next page shows the causes of fire in each of the several classifications. The table of fire causes indicates that schools are not particularly different from other occupancies, as the more common fire hazards head the list. Eight items are responsible for 217 out of 285, or 76% of the fires for which the cause is reasonably well known.

Smoking appears to be a relatively minor hazard in high and elementary school buildings, but causes most of the fires in dormitory and miscellaneous buildings where smoking is usually unrestricted. Spontaneous ignition commonly takes place in rubbish accumulations, especially when these contain oily sweepings or rags. There are more fires due to this cause in high school and laboratory buildings because chemicals which ignite spontaneously are often used or stored in the laboratories.

Defective heating apparatus seems to be more frequently a cause of fire in the public schools than in the other types of buildings, whereas defective flues or chimneys are an important cause of fire in all the occupancies.

It is interesting to speculate on why there should be such a large proportion of incendiary fires in elementary schools. Many of these, the reports quite definitely state, were set by children. In a few cases the fires were set to cover up thefts.

The number of fires on wooden roofs from chimney sparks confirms the already existing evidence that wood shingles are unsuited to use as a roof covering. Many of these fires were in rural schools where a lack of fire protec-

tion allowed the complete destruction of the building. City schools and schools of considerable size are ordinarily provided with fire retarding roofings.

The table demonstrates the need for good housekeeping in all types of school. Cleanliness would make most of the fires from such causes as smoking and spontaneous ignition, which head the list, practically impossible.

Causes of School Fires.

Number of Fires in Each Kind of School Building.

	High	Elementary	Classroom Buildings	Dormitories	Shops, Labs.	Misc.	All
Smoking	3	4	5	11	2	12	37
Spontaneous ignition	11	5	3	5	7	2	33
Defective heating apparatus	10	14	—	4	4	1	33
Defective flue or chimney	4	8	2	10	3	5	32
Incendiary	6	14	2	5	—	1	28
Defective wiring	9	5	4	3	2	3	26
Sparks from chimney on wooden shingle roof	2	8	1	3	—	2	16
Lightning	1	3	2	3	—	3	12
Exposure	—	5	—	1	1	1	8
Rubbish ignited—cause not known	1	3	—	1	—	—	5
Roofer's furnace or torch	1	1	2	1	—	—	5
Spark from stove or fireplace	—	1	—	1	—	3	5
Motion picture film ignites in machine	—	1	—	—	—	2	3
Bunsen burner	—	—	1	—	2	—	3
Matches	—	1	1	1	—	—	3
Plastic flooring solvent ignited	2	—	—	—	—	—	2
Steam pipe ignites woodwork	1	—	—	—	—	1	2
Phosphorus	1	—	—	—	1	—	2
Illuminating gas ignited	—	1	—	1	—	—	2
Overheated oil baths	—	—	—	—	2	—	2
Miscellaneous known causes*	4	6	2	7	5	2	26
Unknown	49	69	29	52	18	22	239
	105	149	54	109	47	60	524

*One fire for each of the following causes:

High School Buildings
Gasoline ignited.
Kerosene ignited.
Alcohol ignited.
Sparkler.

Classroom Buildings
Unknown chemicals "exploded."
Sulphuric acid spilled.

Workshop and Laboratory Buildings
Defective oven.
Match ignited flammable vapors.
Heating smokeless powder.
Ether ignited.
Overheated electric motor.

Miscellaneous Buildings
Gasoline ignited by hot automobile engine.
Grease on stove ignited.

Elementary School Buildings
Gasoline lamp "exploded."
Fumigating candle.
Hot ashes.
Acetylene torch.
Kerosene lamp fell.
Candle on Christmas tree.

Dormitories
Electric iron.
Electric toaster.
Electric curling iron ignited "celluloid" tray.
Gas water heater.
Defective incinerator.
Overturned kerosene stove.
Kerosene lamp "exploded."

The front entrance of the principal building of Wellesley College, Wellesley, Mass., after the fire of March 17, 1914. The fire, starting in a chemical laboratory on the fourth floor at 4:30 A.M., swept through the open hallway shown in the picture, which served as a flue to spread the fire throughout the building. Two hundred girls asleep in the building at the time escaped without casualties by reason of an excellent fire drill. The building was a total loss.

The leading causes as shown by the above table being smoking and spontaneous ignition, both the usual result of untidy conditions, emphasize the need of attention to good housekeeping by school administrators. So many fires, too, from defective chimneys and heating apparatus show that an annual inspection and repair of all heating equipment, flues and chimneys is necessary. The record further emphasizes the importance of fire-resistive roof coverings and, in the case of isolated buildings, of lightning protection. The large proportion of fires of unknown cause does not indicate any mystery inherent in the origin of school fires; many of the fires here reported as of unknown cause could doubtless have been assigned to some definite cause if they had been promptly investigated by an experienced fire inspector.

The following table indicates the manner of discovery of fire.

Manner of Discovery of Fire.

Number of Fires in Each Kind of Building.

Fire discovered by	High	Elementary	Classroom Buildings	Dormitories	Shops and Labs.	Misc.	All
Outsider	67	76	17	10	8	13	191
Employee	14	39	20	33	26	18	150
Student or pupil	7	12	2	47	7	9	84
Sprinkler alarm	1	—	—	—	2	4	7
Auxiliary alarm set off by fire	1	—	—	—	—	—	1
No data	15	22	15	19	4	16	91
	105	149	54	109	47	60	524

The preponderance of discoveries by outsiders in the case of public schools is explained by a succeeding table, which shows that a majority of the public school fires occur while the building is not occupied. High schools have a larger proportion of their fires discovered by outsiders than elementary schools. This may be partly explained by the fact that high school buildings are usually larger than elementary school buildings, so that if the fire starts in a part of a building remote from where the janitor or watchman is located an outsider is more likely than he to see it first.

In contradistinction to this, dormitory fires, most of which occur when the building is occupied, are discovered by the occupants. In nearly every case where automatic sprinklers were involved, the alarm was given by the sprinkler alarm. In one case, as noted, the breaking of an auxiliary alarm circuit by the fire gave warning about it.

The following table is a brief summary of the principal fire protection available at each fire.

Available Fire Protection.

Number of Fires.

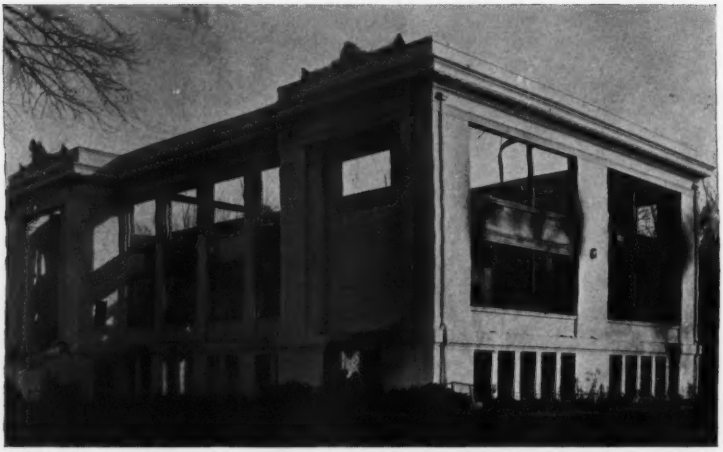
	High	Elementary	Classroom Buildings	Dormitories	Shops and Labs.	Misc.	All
Some water supply	48	87	33	52	32	35	287
Water supply inadequate	9	4	10	15	5	9	52
No water, but fire department and chemicals used	7	6	—	4	—	—	17
No fire protection	16	29	4	18	5	5	77
No data	25	23	7	20	5	11	91
	105	149	54	109	47	60	524

The reports reviewed in preparing this table in few cases made any reference to first aid fire protection. It was noted in one or two reports that attempts were made to use extinguishers but that these were found to be inoperative. Private fire protection was also found to be entirely inadequate

The burning of a country school. Fire department and available fire apparatus in foreground.

in several cases. In a number of fires first aid appliances were available in proper quantity and apparently well maintained and were used to control the fire in its incipiency. The absence of data in the reports about first aid appliances seems to indicate that these were too generally lacking.

The above table shows that in most cases there was some sort of water supply available. In the cases included in the first heading the reports stated that several streams of water were obtainable, or the fire occurred in premises where a supply of water was known to be available, whether or not a factor in the control of the fire. The most noticeable fact brought out by this table is the large number of cases where fire protection was inadequate or totally lacking. This was especially true of rural public and private schools and small colleges situated at a distance from a protected village or town. In some instances an attempt had been made on the part of the school to provide some sort of water supply for fire protection, but this was in many cases totally inadequate. Fire fighting facilities were often missing when there was available an adequate force of students or other people to do volunteer



Fireman's Fund Record.

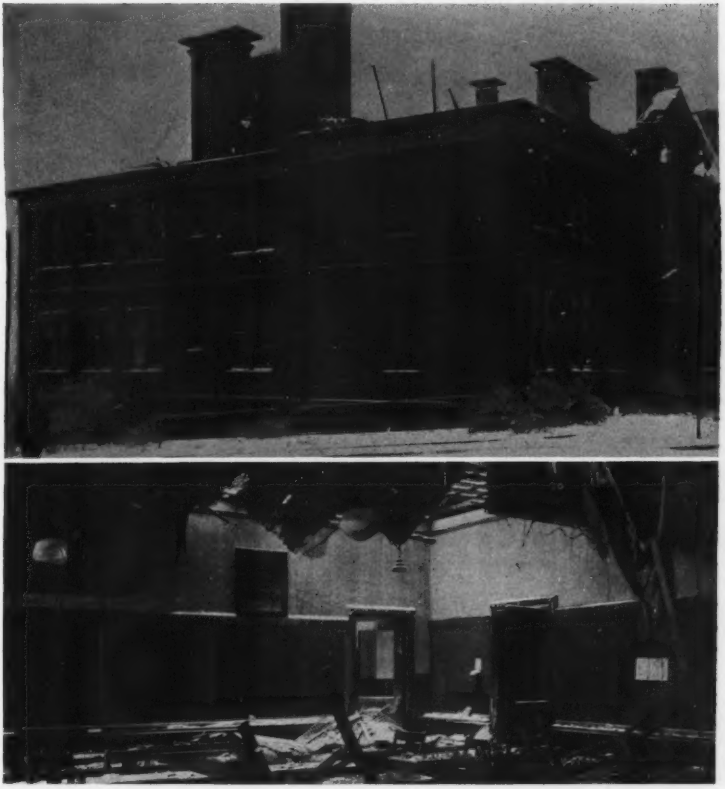
The high school in Woodland, Calif., was destroyed by fire on December 31, 1923, with a loss of $220,000. The exterior walls of this building were of concrete, as the picture shows, and likewise the corridors were of fire-resistive construction. The balance of the interior, of wooden construction, was completely gutted. Practically no insurance was carried on this building, as the school trustees did not think that a structure of this character could burn.

fire fighting. The fires show that many private school properties would have wisely spent some money on chemical engines or hose equipments.

Construction of Buildings.

	Number of Fires.						
	High	**Elementary**	**Classroom Buildings**	**Dormitories**	**Shops and Labs.**	**Misc.**	**All**
Brick or stone walls with wooden interior	66	80	34	49	23	23	275
Frame	14	41	5	34	8	16	118
Fire-resistive	1	—	4	3	14	9	31
Brick veneer	4	8	1	1	—	1	15
Partly fire-resistive	6	2	1	—	—	1	10
Stuccoed frame	2	—	1	—	—	1	4
Concrete block walls — wooden interior	—	2	—	1	—	1	4
No data	12	16	8	21	2	8	67
	105	149	54	109	47	60	524

The predominating construction of the school buildings involved in the fires recorded is, as the above table shows, "ordinary construction." That is, masonry walls with wooden interior. About half of the buildings in this classification were described as of brick and wood-joist construction—the remainder were described variously as "brick" or "stone," the usual meaning



Newark Evening News.

The South Orange, N. J., High School was visited by fire on January 8, 1926, with a loss estimated at $200,000. The upper picture shows the general appearance of the building, the lower a portion of the interior where metal lath and plaster ceilings were pulled down during the fighting of the fire in the attic space above.

of these terms being that the walls were of brick or stone but that the interior was of ordinary wooden construction. It is possible that some of these were in reality brick-veneered only. It is somewhat less likely, though of course possible, that there may be a few fire-resistive buildings included in this classification. Usually a fire in a fire-resistive building is a sufficient surprise to warrant mention of the type of construction in the report. It may be assumed therefore that the majority of these fires were in buildings of combustible construction.

The number of fires in fire-resistive buildings, shown in the table, is increased by the reports of several small and inconsequential fires in two

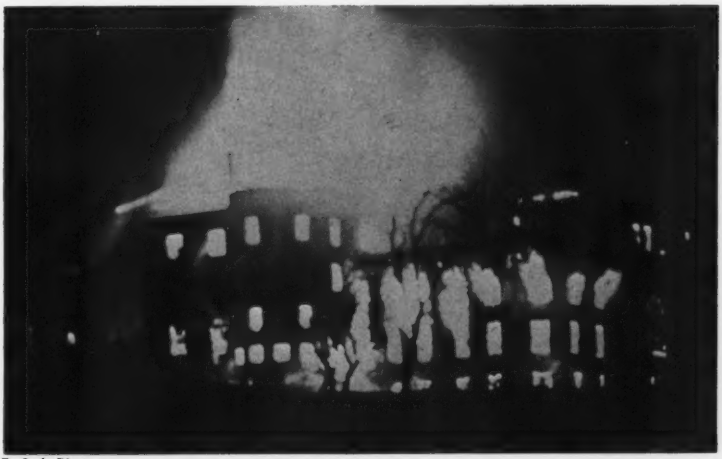
Fireman's Fund Record.

A portion of the interior of the Lincoln School, Sacramento, Calif., after the fire of April 29, 1927. This was a large frame building and burned rapidly despite the best efforts of a well-equipped fire department.

fire-resistive technical school buildings. Very few of the schools included in this record were fire-resistive. A few were partly so: some had fire-resistive walls, corridors, etc., but otherwise constructed of wood; some had fire-resistive basements only, and a few were fire-resistive except for the roof.

The relatively higher number of frame dormitories included is due to numerous fires in small dormitories of private schools.

The combustible construction was responsible for the complete destruction of many of the buildings in these fires. The combustible wooden interiors, basements not cut off, stairways unenclosed, all contributed to the spread of fire. These fires were difficult to control even where the fire department arrived promptly. The fact that most of the fires occurred when the buildings



P. & A. Photo.

The Randolph-Macon Military Academy, Front Royal, Va., was destroyed by fire early in the morning of January 10, 1927, with a loss of $120,000. Starting from unknown cause during the night, the fire spread rapidly and was practically beyond control when discovered. One hundred and eighty-five boys were in the building at the time. All escaped with their lives, but ten were injured by burns or by jumping from upper stories.

were unoccupied, tended to delay alarms and to prevent attacking the fire while small.

The following analysis of the losses reported shows how large a proportion of the fires in this record were severe losses. This is due partly to the fact that the N.F.P.A. Department of Fire Record does not receive reports on the many inconsequential fires in schoolhouses. The generally combustible construction, usual delay in discovery of the fire and frequent lack of fire protection are reasons why the loss is ordinarily large when a school building catches fire.

Analysis of Loss.

	Number of Fires.						
Loss	High	Elementary	Classroom Buildings	Dormitories	Shops and Labs.	Misc.	All
Over $1,000,000	—	—	1	—	—	—	1
$100,000-$1,000,000	27	17	12	24	6	13	99
$10,000-$100,000	54	83	26	45	13	20	241
$1,000-$10,000	12	14	4	19	9	9	67
$100-$1,000	1	5	4	9	6	6	31
Less than $100	4	6	2	4	5	8	29
No data	7	24	5	8	8	4	56
	105	149	54	109	47	60	524

The burning of Dickinson Hall, Princeton University, May 15, 1920. In this fire were destroyed irreplaceable works of art and historic collections. Automatic sprinklers would have prevented this loss.

Only a very few of the buildings in which these fires occurred were equipped with automatic sprinklers. The performance of sprinklers was uniformly good, however, controlling the fire in all but one instance. In this case the fire was in a stock room where piles of paper stock prevented proper distribution from the sprinklers.

The small number of sprinklered fires is primarily due to the fact that a relatively small proportion of schools have been equipped with automatic sprinklers. Also, where sprinklers are installed, such fires as occur are controlled with the opening of one or two sprinklers and a negligible loss, and so are not reported. Partial sprinkler installations protecting basements, laboratories, kitchens and other hazardous portions are frequently found in school properties; this accounts for the relatively large number fires where the sprinklers were not a factor.

Effect of Sprinklers.

	High	Elementary	Classroom Buildings	Dormitories	Shops and Labs.	Misc.	All
Extinguished fire	1	—	1	1	7	5	15
Held fire in check	—	—	—	1	5**	1	7
Failed to extinguish fire	1	—	—	—	—	—	1
Not a factor*	—	3	1	—	2	2	8
	2	3	2	2	14	8	31

*By "Not a factor" is meant fires in sprinklered buildings where the fire was extinguished before it was large enough to open the sprinklers, or where the fire occurred in an unsprinklered portion of the building.

**In two cases the fire started in an unsprinklered portion of the building. The sprinklers helped to prevent the spread of fire from the unsprinklered part.

Summary of Sprinkler Efficiency.

	No. Fires	%
Practically or entirely extinguished fire	15	65.3
Held fire in check	7	30.4
Total where performance was satisfactory	22	95.7
Unsatisfactory	1	4.3
Total	23	100.0

Room in Which Fire Originated.

Number of Fires.

Location	High	Elementary	Classroom Buildings	Dormitories	Shops and Labs.	Misc.	All
Boiler or furnace room	14	26	1	7	4	5	57
Basement, various portions	7	20	5	13	—	2	47
Roof	6	17	6	12	—	5	46
Attic	10	9	6	10	3	5	43
Chemical or similar laboratory	7	—	7	2	12	1	29
Classroom	4	8	4	—	1	3	20
Assembly room	12	4	1	—	—	1	18
Closet	6	4	2	6	—	—	18
Wastepaper room or chute	2	7	2	1	2	1	15
Domestic science room or kitchen	3	1	—	7	1	1	13
In walls or floors	1	3	3	4	—	—	11
Student's room	—	—	—	11	—	—	11
Hallway	2	1	—	6	—	—	9
Manual training room	4	2	1	—	1	—	8
Gymnasium	—	4	—	—	—	2	6
Teachers' office	1	2	1	—	—	1	5
Coal bin	3	1	1	—	—	—	5
Neighboring building	—	3	—	1	—	—	4
Mechanical laboratories	—	—	—	—	3	1	4
Library	1	—	1	—	—	1	3
Coat or locker room	—	3	—	—	—	—	3
Laundry	—	—	—	2	1	—	3
Chemical supply room	1	—	—	—	2	—	3
Under building—no basement	—	3	—	—	—	—	3
Frame shed	—	—	1	—	—	2	3
Washroom	1	—	1	—	—	—	2
Elevator shaft	—	—	—	1	1	—	2
Living room	—	—	—	—	—	2	2
Miscellaneous known location*	—	1	—	1	5	10	17
No data	20	30	11	25	11	17	114
	105	149	54	109	47	60	524

*One fire was recorded in each of the following locations:

Elementary School Buildings
Bonfire in yard.

Dormitories
Belfry of convent.

Workshop and Laboratory Buildings
Lumber stockroom.
Foundry.
Wood drying room.
Pumping station.
Dissecting room.

Miscellaneous Buildings
Athletic supply room.
Slaughter house.
Projection room.
Book and supply room.
Janitor's room.
Hospital ward.
Bowling alley.
Armory.
Icehouse.
Stable.

P. & A. Photo.

The Franklin Preparatory School, Cincinnati, Ohio, was destroyed by fire on February 1, 1926, with a loss estimated at $75,000. The fire started in the furnace room of this fifty-year old frame building and spread rapidly to the upper stories. No one was in the building at the time.

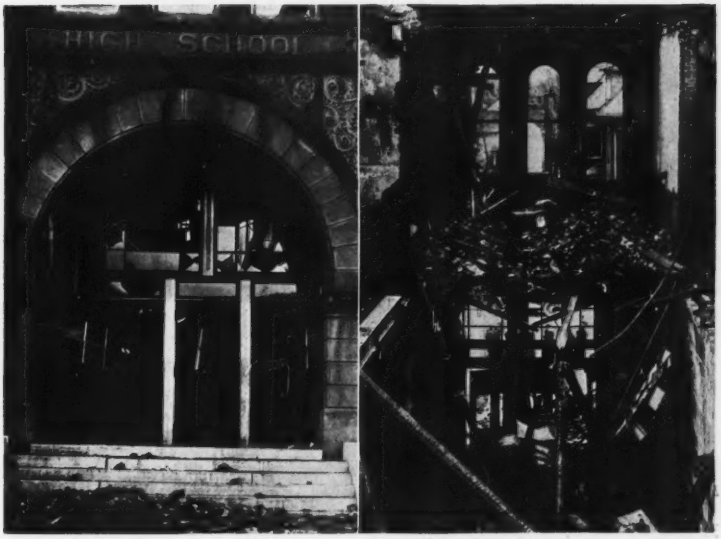
General Location of Origin of Fire.

	High	Elementary	Classroom Buildings	Dormitories	Shops and Labs.	Misc.	All
Basements	26	54	9	22	7	8	126
Classroom or office	20	19	7	6	1	9	62
Roof or exposure	6	24	7	13	—	7	57
Attics	10	9	6	11	3	5	44
Closets and concealed spaces	8	10	6	10	—	3	37
Other known portions*	15	3	8	22	25	11	84
	85	119	43	84	36	43	410

The second table shows more clearly than the first the hazardous portions of the buildings. The basement stands out as the most frequent source of the fires. This has been known to be the most hazardous portion of the building. Member Henry A. Fiske, using data from the relatively few school fire reports then available, pointed out in the *Quarterly* (Vol. 14, No. 3, page 272) that over one-quarter of the fires in schools were in basements. He argued from that fact, which the above table also shows, that even partial installations of automatic sprinklers, particularly for basements, would in many cases be helpful when funds are not available to sprinkler the whole building.

The above table shows that the basement of an elementary school is a relatively greater hazard than the basement of a high school. This is probably due to the fact that high school basements are usually finished, and house

*Includes laboratories, kitchens, workshops, storerooms, living quarters, etc.



Carl S. Steup.

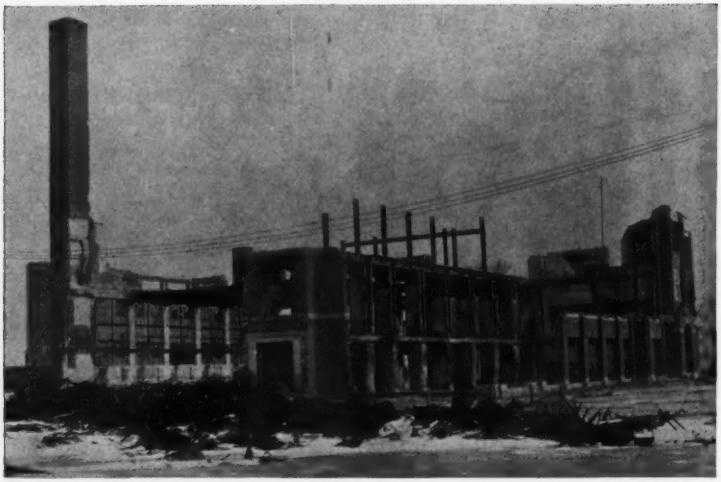
The Richmond, Indiana, High School was destroyed by fire on March 29, 1924. The view at the left shows the front entrance, indicating the general appearance of the exterior construction; the right shows a portion of the ruins. The fire started in the basement and spread rapidly to upper parts of the building through ventilating ducts.

classrooms, lunch rooms, locker rooms, gymnasiums, etc., and are accordingly kept cleaned up, whereas the average elementary school basement is unfinished and frequently its otherwise unoccupied spaces become catch-alls for old furniture and rubbish. The heating plants of elementary schools are often less well installed than in the larger high school buildings.

Roof fires are second in importance in the case of elementary school and dormitory buildings. This is due to the use of wooden shingle roofings, which is quite common on rural elementary schools and small frame dormitories of private schools.

Occupancy of Building at Time of Fire.

The following tables deal with the occupancy of the building at the time of the fire, and as such the information they contain is interesting in connection with the record of loss of life in school fires elsewhere in this issue. The following tables show that in all school buildings except dormitories the chances are greater that the fire will start when the building is empty rather than when occupied. For this reason the statistics on dormitories are presented separately from those on other occupancies.



Fireman's Fund Record.

About January 1, 1925, the Lincoln Consolidated School near Ypsilanti, Michigan, was completed for occupancy. The building was a three-story building of substantial appearance, covering a ground area of 17,500 square feet. This picture shows the building after the fire of December 5, 1925. The fire occurred in the night, spread rapidly in the interior combustible construction, and so damaged the exterior walls as to require practically complete rebuilding.

Occupancy at Time of Fire.

	High	Elementary	Classroom Buildings	Shops and Labs.	Misc.	All except Dormitories
Empty at time of fire	75	86	31	18	18	228
Occupied at time of fire	13	32	11	10	16	82
No data as to whether occupied or not	17	31	12	19	26	105
	105	149	54	47	60	415

Dormitories.

	Day Fire	Night Fire	Total
Occupied at time of fire	33	48	81
Empty at time of fire	—	—	5
No data except time of fire	6	1	7
No data as to whether occupied or not	—	—	16
	39	49	109

It would be interesting in the case of fatal school fires to know just how much a factor a fire drill might have been in getting people out of the building, or how frequently lack of it was a direct cause of fatalities. The reports in this record, however, do not show these facts except in a few cases. The following tables do show, as far as data could be taken from the reports, how the exit was made in each case. Except in the case of dormitories no

P. & A. Photo.

Burning of a high school at Garfield, N. J., June 23, 1927. The fire, which started in the chemical laboratory shortly before the beginning of the day's session, did damage estimated at $80,000. This modern building had substantial brick walls, but the interior was largely of combustible construction.

attempt has been made to separate day from night fires, as except in dormitories, the time would make no difference, the occupants being usually awake.

How Exit Was Made.

Number of Fires.

	High	Elementary	Classroom Buildings	Shops and Labs.	Misc.	All except Dormitories
Exit made in good order	4	10	—	—	1	15
All got out—no data on how	1	3	3	—	1	8
Some occupants killed or burned	—	5	—	—	2	7
Exit made in disorder	1	3	1	—	—	5
Rescues effected with ladders	1	1	—	—	—	2
Not a factor*	78	92	36	33	25	264
No data	20	35	14	14	31	114
	105	149	54	47	60	415

Dormitories.

	Day Fires	Night Fires	Total No. Fires
Some occupants killed or burned	1	11	12
Exit made in good order	3	6	9
All got out—no data as to how	—	8	8
Exit made in disorder	—	6	6
Not a factor*	—	—	19
No data	—	—	55
	4	31	109

*By "Not a factor" is meant cases where the building was empty at the time of the fire, or that due to the unimportance of the fire no attempt was made to empty the building, or that the loss of life resulted from direct burns, attempted salvage, etc., where the means of exit was not a factor.

School Fires Showing the Value of Drills.

H-9967. TORONTO, ONT., FEB. 24,1914. Fire which started in the first floor of an old school building was first seen by a pupil in the kindergarten class. The principal of the school when informed of the fire sounded the gong for the fire drill. The building contained about 800 pupils and was emptied in an orderly manner. As the fire did not reach the stairs and could not be seen by the pupils in the hall a panic probably was averted. The fire when first seen was inside the hollow partitions where it could not be reached with a chemical extinguisher which was brought into use. The public fire department used twelve hose streams in extinguishing the fire. The building was practically destroyed.

H-15275. LONG BEACH, CAL., DEC. 27, 1918. Fire started in the furnace room of a grammar school from defective heating equipment. Fire was communicated to all parts of the building through the heating and ventilating ducts before it was discovered. More than six hundred students, ranging in age from the kindergarten to the eighth grade, and their teachers were out of the building within two minutes after the fire alarm was sounded.

H-21856. BOSTON, MASS., FEB. 10, 1925. Fire started from an overheated furnace just as the children in a public primary school were about to be dismissed. The fire drill bell was sounded and the pupils under the guidance of the teachers were marched down the stairways and fire escapes to the street in safety.

H-22685. LAWRENCE, MASS. Nov. 10, 1925. Fire broke out after an explosion in the oil heating system of a parochial school while the school was in session. The fire drill signal was sounded when smoke began to fill the schoolroom and the children made an orderly exit from the building.

Fires in Schools with Automatic Sprinkler Protection.

S-28791. NEW YORK CITY, SEPT. 17, 1920. Fire started in the porter's room of a business college, located on the third floor of a tenant building. It was probably caused by spontaneous ignition of oil-soaked rags used for oiling the floor. Fire was extinguished by the operation of one sprinkler head.

S-31822. NEW YORK CITY, OCT. 1920. Fire started in the waste paper room near the bottom of the elevator shaft of a university building where waste paper is collected and baled. It was thought that a lighted cigarette was thrown into this paper from the elevator. Two sprinklers operated and entirely extinguished the fire. The loss was small.

Underwood & Underwood.

Stone Hall, Wellesley College, Wellesley, Mass., burned on March 7, 1927. The fire, supposedly due to smoking by workmen engaged in making alterations, damaged this $400,000 building beyond repair.

S-32753. NEW YORK CITY, MARCH 11, 1922. Instructions in pattern designing for clothing trade were given in this school, which occupied the eighth floor of a tenant building. Waste paper, which was thrown in a corner near the exit, was ignited by a cigar or cigarette. The fire smouldered for some time before breaking into flames. The fire in the waste, which was shielded from the sprinklers by tables and covered wardrobes, allowed a great deal of heat to rise to the ceiling before the sprinklers could reach the fire. Ten sprinklers operated before the fire was entirely extinguished. The loss was moderate.

S-33066. CAMBRIDGE, MASS., SEPT. 15, 1922. Fire started in the laboratory of a fire-resistive technical school building. An oil bath under a wood-frame asbestos-lined hood with a metal duct over it became overheated and ignited. The wood frame of the hood door caught fire. One sprinkler over the hood operated and held the fire in check. The hood prevented the sprinkler from entirely extinguishing the fire. The private fire brigade used three foam extinguishers to extinguish the fire. The loss was approximately $200.

S-38850. NEW YORK CITY OCT. 5, 1924. Fire started in a university chemical laboratory, located in a tenant building. It was probably caused

from spontaneous ignition of chemicals and waste. Fire had burnt into wood finish of the floor when one sprinkler operated and practically extinguished it. The loss was small.

S-39426. LOWELL, MASS., MARCH 9, 1925. Fire started in the chemical laboratory of a textile school. It started in a wooden case with glass doors used for the storage of various inorganic chemicals and was probably due to spontaneous ignition of yellow phosphorus. One sprinkler operated and practically extinguished the fire. The public fire department used a chemical extinguisher to complete the extinguishment. The fire loss was negligible. Water damage amounted to $800.

S-41984. CAMBRIDGE, MASS., APRIL 13, 1926. Fire started in a college chemical laboratory. The building was of fire-resistive construction. The rubber tubing became disconnected from a gas burner and ignited the woodwork of the laboratory bench. One sprinkler operated and a foam extinguisher was used to assist in extinguishing the fire. The loss was negligible.

Motion Picture Film Fires in Schools.

H-17908. SEATTLE, WASH., MAY 14, 1920. A 1000 foot reel of standard nitro-cellulose film was being used in a small motion picture machine without a fire-resistive booth. The automatic shutter over the aperture had become stuck in an open position and this exposed the stationary film to the rays from the lamp, which was a 400 watt lamp. This caused the film to take fire. The blazing machine was carried through the room and thrown outside the building. The audience of children were badly frightened but panic was fortunately averted. The loss, which was small, was confined to the film and the machine.

H-19005. STERLING, KANSAS, NOV. 1, 1921. A slow-burning type film was being shown in a grade school before approximatively 100 children. The janitor had been repairing the machine and there was one piece that he could not get into its proper place, and as the class was ready they decided to leave the piece out. While the janitor and one of the older boys were operating the machine the film caught fire. The machine was badly damaged and the piano on which the machine was set was slightly damaged. The children were removed from the building in safety.

S-44194. ROCHESTER, N. Y., NOV. 28, 1926. A fire which started in the motion picture film projection room of a university building was caused by the ignition of motion picture film in one of the machines. Two sprinklers operated, and chemical extinguishers were used to assist in extinguishing the fire. Loss was between $300 and $500. This fire illustrates the value of standard arrangement and protection where motion pictures are to be shown in schools.

St. Croix Paper Company Fire.

Report by Underwriters' Bureau of New England.
(Member N. F. P. A.)

An oxy-acetylene welding outfit used in a paper mill building while the sprinklers were shut off during repairs was responsible for a fire in the plant of the St. Croix Paper Company, Woodland, Maine, on September 8, 1927, doing damage estimated at $100,000. This fire affected two of three paper making machines of this mill; it is reported that it may be four months before full production can be resumed. Shortly after the outbreak of the fire the sprinklers were turned on and 214 out of 216 heads in the room opened. The static pressure of the sprinklers operating was fifty pounds, the supply coming from a 75,000 gallon gravity tank and three fire pumps which served as a secondary supply. Despite the apparently ample water supply to the sprinklers they were not effective in controlling the fire. Within a few minutes the collapse of roof trusses broke sprinkler piping and sprinklers were of no further value.

Construction of the Building.

This building was a one-story building with brick walls and fire-resistive floor. The roof was of 2½ inch plank on an unprotected steel truss. The room was 244 ft. x 80 ft. and houses two newsprint paper machines. This building is fairly well cut off from the balance of the plant and the fire was practically confined to this area.

The 2½ inch planking of the roof had been badly rotted by the moist atmosphere above the paper machines and was being replaced by a built-up roof of a composite material formed of cement and asphalt. At the time of the fire about three-quarters of the roof had been replaced. During the work a false roof deck of planks was laid below the main roof. This was supported on the lower cord of the trusses, which were eight to nine feet deep. This deck served as a working platform and to protect the machines below. While placing the new roof some reinforcing work was being done on the end members of the roof trusses which were built up of angle irons. It is said that this work did not weaken the trusses and that their collapse was not due to it. The sprinkler piping was being overhauled and all pipe which did not appear to be in perfect condition was being renewed, as it was felt that the opportunity to do this might not occur again for some years. At the time of the fire the sprinkler pipe in several bays was disconnected, one 2½ inch pipe was open and the outside control valve was shut.

Ruins of the paper mill at Woodland, Maine, after the fire of September 8, 1927. An oxy-acetylene welding outfit was in use for repair operations while the sprinkler system was shut off.

Story of the Fire.

An oxy-acetylene welding outfit was being used in the space between the temporary deck and the roof. This outfit consisted of a 100 cubic foot capacity tank of dissolved acetylene gas under pressure of between 200 and 300 pounds per square inch and a 200 cubic foot cylinder of oxygen at a pressure of about 2,200 pounds per square inch.

Apparently, the rubber tubing broke and the flame flashed back through the tube into the acetylene tank. The safety plugs and the valve were opened and a considerable quantity of burning acetylene gas was released in the confined space between the roof and the deck. After the fire, the safety plugs on the oxygen tank were also found to have been released, but it is not known when this occurred. The men working in the area were slightly burned in their hasty escape through the hole in the roof.

The "boss-piper" states that he had left his men working here, shortly before the fire and was but a short distance away when he heard cries and saw smoke. He immediately opened the sprinkler control valve. Within a few minutes from the start of the fire 12 of the roof trusses collapsed. This interval is variously estimated to have been from 7 to 12 minutes.

The collapse broke off one of the 5-inch sprinkler risers, and as the sprinklers were then of no use the control valve was again shut.

A strong wind blowing down through the roof opening, assisted by the ventilator ducts, had transmitted the heat to all parts of the room, so that 214 of the 216 sprinklers under the roof operated.

After the roof collapsed, it was merely a question of confining the fire to the room and extinguishing the blaze in the fallen débris, consisting of the

old roof, deck and wooden hoods and ventilators over the machines. This was readily done by the use of 8 and later 10 hose streams which had been promptly put in service.

As there was no combustible material under the half of the roof which did not collapse and as the under side of the new roof covering is not combustible, there was no fire here.

The fire originated at about 9:30 A.M. and within an hour it was extinguished and plans were underway for removing débris and restoring damaged machinery.

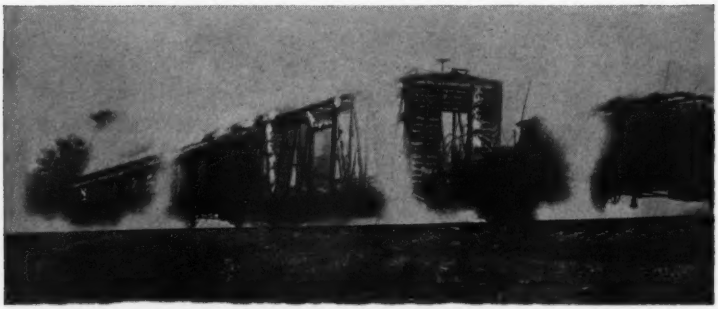
Gasoline Truck and Train Collision and Fire.

Report by G. K. Monroe.

A gasoline tank truck stalled on a grade crossing at Cridersville, Ohio, on August thirteenth. A train came at a reported speed of fifty-five miles an hour. The truck driver jumped. He got clear of the collision, but was showered with blazing gasoline and died within a few hours as a result of his burns.

The burning gasoline enveloped the train. The engineer and fireman were burned to death in the cab. The train went on, speed unchecked, the forward cars all ablaze, until a trainman set the brakes, bringing the train to

Four men were burned to death when this train hit a gasoline tank truck on a grade crossing at Cridersville, Ohio, August 13. The locomotive and forward cars were showered with blazing gasoline. The engineer and firemen were burned to death in the cab.



A view of the burning train taken shortly after it had been brought to a stop. An express messenger was burned to death in the car at the right of this picture.

a stop half a mile beyond the crossing. The passengers then escaped before the fire spread to the rear cars. Two hours later the body of an express messenger was found, burned to death, in the baggage car where he had been trapped, making the total toll of life four.

Railway mail clerks saved only the registered mail. The damage to the train is indicated by the accompanying photographs, which were taken shortly after the train came to a stop and while the fire was still burning fiercely. The heat was sufficient to warp the rails, which had to be replaced.

Fires in Which There Was Loss of Life.

These notes are intended to point out typical conditions under which loss of life has occurred, that they may be known and guarded against.

Children Alone in House.

L-136. OTTAWA, ONT., JULY 11, 1927. Four children, who were left alone in the house, were burned to death, when fire broke out while they were asleep in an upstairs room. The oldest girl, who was in the yard, saw the flames and ran into the house. She was badly burned in her futile attempt to rescue the other children.

Fireworks.

L-131. FITCHBURG, MASS., JULY 1, 1927. A five-year-old girl, while playing on the piazza of her home, obtained a Chinese candle from some one in the house. She lit the candle and while swinging it around in the air her clothing caught fire. Two men who were working near by tore off her clothing, and she was taken to the hospital, where she died.

L-132. WAKEFIELD, MASS., JULY 6, 1927. A seven-year-old girl was lighting a sparkler when she set fire to her clothing with the match which she was using. Her body was badly burned before the fire was extinguished, and she died in the hospital.

Bonfire.

L-133. LAWRENCE, MASS., JULY 6, 1927. A four-year-old girl was playing around a bonfire in the yard of her home the night of the Fourth. She was badly burned and died two days later from her burns.

Smoking in Bed.

L-130. ABINGTON, MASS., JULY 1, 1927. An aged man was smoking in bed and set fire to the bed clothing. His body was found the next morning lying on the bed. Death was due to suffocation. The bed clothing and other articles in the room had been burned, but neither the fire nor the smoke had penetrated beyond the room. The fire had evidently burned itself out from lack of draft, as the window was closed.

Gasoline and Kerosene

L-141. FORT DODGE, IOWA, AUGUST 18, 1927. A woman was attempting to start a fire in the kitchen stove with kerosene. When she touched a match to the kindling an explosion occurred. She was not burned in the explosion, but was fatally burned when she attempted to reach her children, who were sleeping upstairs.

H-24901. ELIZABETHPORT, N. J., MARCH 29, 1927. SHIPYARD AND DRY DOCK. An employee was starting up the fire in the small heating boiler in the machine shop. The fire did not start as quickly as he wished, so he took a can of kerosene and turned it into the fire box. The fire flashed out and ignited his oil-soaked overalls, and he was so badly burned that he died in the hospital.

L-140. SHELBY, MICH., AUGUST 14, 1927. A large drum of gasoline near which a woman was working exploded, and set fire to her clothing. She rushed into the living room where her father, who was seriously ill, was lying on the couch. The shock of the sight of his daughter with her clothing afire was so great that he died instantly. Her husband extinguished the fire in her clothing, but she died from her burns.

L-142. NORWALK, OHIO, AUGUST 14, 1927. Gasoline, which was mistaken for kerosene, was poured on a fire in the cook stove. A three-year-old child was killed almost instantly and four other members of the family were taken to the hospital, where they died the next day.

H-24819. SAN JOSE, CALIF., JULY 15, 1927. Three men were burned to death, and three more were severely burned in a gasoline explosion. An automobile in which they were riding struck a gasoline service station and the impact broke off two gasoline pumps. The automobile overturned and burst into flames. Three of the men were thrown out of the machine, while the three men who were trapped in the car were burned to death.

H-24858. FEDERALSBURG, MD., JUNE 30, 1927. GASOLINE STATION. A tank truck, which was being filled with gasoline from a storage tank, overflowed and the gasoline caught fire. The exact cause of the gasoline catching fire will never be known, as the driver of the truck was so badly burned that he died a few hours later.

Paints and Chemicals.

H-24695. VANCOUVER, B. C., JULY 9, 1927. APARTMENT HOTEL. A fire, which started on the fourth floor of a seven-story building, spread so rapidly that seven people, three of them children, lost their lives. Several other guests at the hotel were also injured while making their escape. The fire started when a cigarette was dropped into a can of highly flammable paint remover, which was being used in one of the apartments.

H-24847. LEON, KANSAS, JUNE 7, 1927. SCHOOL. Three boys were painting the roof of the building. One of them was in the attic mixing the paint when the fire started. It spread so rapidly that he was unable to escape before he was fatally burned. The other boys were rescued with difficulty.

S-45496. RENSSELAER, N. Y., JUNE 9, 1927. CHEMICAL AND DYE WORKS. A fire followed the explosion of a ball mill in which chrome red

brown was being pulverized. One man who was passing the mill when the explosion occurred was so badly burned that he died.

S-45608. TURTLE CREEK, PA., JULY 2, 1927. METAL WORKER. Varnish and benzine stored in buried tanks are handled by means of pumps located in an underground pump house near by. The engineer entered the pump house to start the varnish pump. No lights were burning at the time, and presumably he turned on the light switch just before passing down the stairway. Immediately an explosion occurred, caused no doubt by a spark at the switch igniting an explosive mixture of the flammable vapors and air. The engineer managed to get away, but he was so badly injured that he died a short time after reaching the hospital.

Fuse.

S-44847. EAST NEWARK, N. J., APRIL 28, 1927. COTTON MILL. An operator threw in a switch to start a motor drive on a ring spinning frame. The fuse, which was enclosed, blew out and the cover of the fuse box was also blown off. The operator's clothing caught fire and instead of trying to extinguish the fire she ran about the factory. Another girl stopped her and tried to extinguish the fire, but her dress also became ignited. The flames were finally extinguished by other employees and both girls were taken to a hospital. The girl who ran about the mill died from her burns.

Fire Fighting.

H-24815. ATLANTA, GA., JULY 30, 1927. WAREHOUSE. Two firemen were killed and eight other men were badly injured, when with practically no warning the walls of the building, weakened by the flames and forced out by the pressure caused by the expansion of the wet hay and grain, collapsed. The chief of the fire department before being called away from the fire gave orders for the men to keep clear of the crumbling walls. One of the companies arrived shortly after the chief left and the captain was not told of the chief's order to keep away from the walls and caused a ladder to be placed from a vacant building, some 12 feet away, to the window. The wall fell against the adjoining building with the above result.

L-145. WILMINGTON, MASS., SEPTEMBER 11, 1927. Two firemen were killed and another badly injured when a chimney collapsed after fire had destroyed a two-story dwelling. The three firemen were playing a hose stream on the smouldering ruins when the chimney fell on them.

Fire Trap Building.

H-24898. BOSTON, MASS., OCTOBER 2, 1927. A fire, starting from a carelessly dropped cigarette, caused the deaths of an entire family, consisting of father, mother and three children. It started on the first floor of a four-story tenement building and the family who lost their lives from suffocation

occupied the third floor. One of the occupants, after jumping from the third floor, ran to a fire alarm box and was found with a hysterical woman pounding on the box, by one of the occupants of the second floor when she reached the box. She finally succeeded in pushing them away and seized the lever of the box, but she was so exhausted when she finally reached the signal hook that she did not have the strength to pull it. She shouted to a man who was running toward the fire and he pulled in the alarm. Although there was a delay in sending in the alarm the deaths resulted from suffocation and were presumably not chargeable to the delayed alarm.